The Welding Engineer

Reg. U. S. Pat. Office

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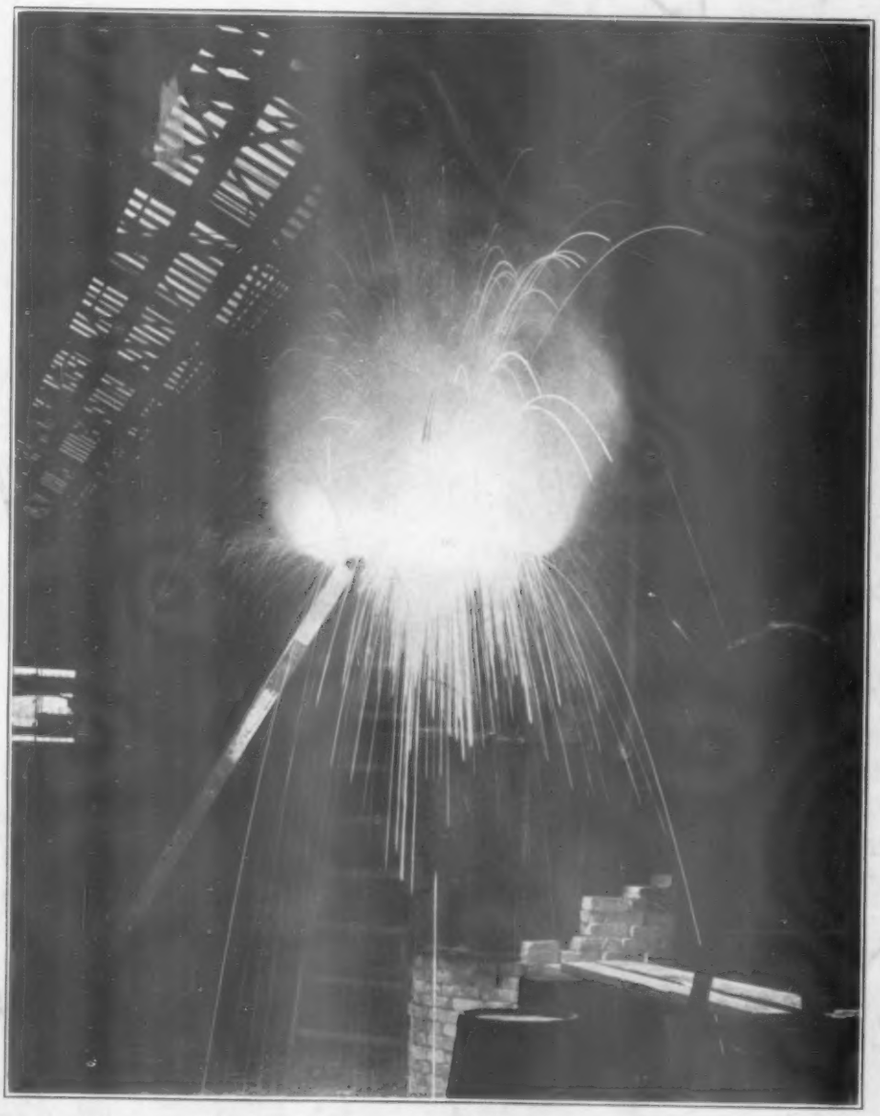

neer Business and Technical Journal of the Welding Industry

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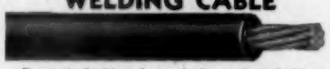

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5	661	0.400	75	3.58	220
4	1052	0.495	100	3.18	300
3	1326	0.500	150	3.70	350
2	1672	0.560	200	3.92	390
1	2109	0.625	250	3.88	500
1/0	2658	0.675	300	8.72	550
2/0	3353	0.750	375	3.68	720
3/0	4227	0.815	450	3.51	930
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250,000 cm	6297	0.950	600	3.12	1250
300,000 cm	7557	1.030	650	2.80	1425

MOST all experienced welders know—and never hesitate to state—that you can't substitute "guesswork" on the job for "test work" at the factory. The reliable way—the proved way—to insure a sound weld every time—is to use Premier Tested Welding Wire—gas or electric—the welding wire that is "shop tested" in the making—and re-tested after the making to insure proved adaptability to every type of job. Greater strength in the finished weld is assured—due to free flowing—deep penetration—uniformity and freedom from impurities. Time is saved—money is saved—and perfect work results. There's a type for every purpose and each length is plainly marked for grade.

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THE WELDING ENGINEER

MAIN CONTENTS OF THIS ISSUE

OCTOBER, 1935

Vol. 20, No. 10

Dies and Punches (Page 19)
Hard-Surfacing Dies and Punches (Ames)

I. A. A. Meeting (Page 21)
Program of the Annual I. A. A. Convention at Cleveland

Preheating (Page 22)
Some Notes on Preheating and Contraction and Expansion (Totten)

Structural-Steel Shops (Page 24)
Controlling Welding in the Structural-Steel Fabricating Shop (Kinkead)

Tests (Page 26)
Inexpensive Weld Tests (Lincoln)

Plate Work (Page 29)
Some Comments on Welding Procedure (Wallin)

Pipeline (Page 32)
All-Welded Irrigation Pipe

Editorial—(Page 17)

Repairs Steel Casting by Thermit Process —(Page 20)

C. A. McCune Receives Miller Memorial Medal—(Page 23)

Plate Fabricator Reports Four Months' Work Ahead—(Page 25)

All-Welded Oil-Storage Tanks in South Africa—(Page 28)

A Welding Engineer's Wife Speaks Her Mind—(Page 31)

Get H. O. T. on Welding—(Page 33)

Portable Compressors Built by Welding —(Page 34)

Mostly About People—(Page 34)

Welding News in Pictures—(Page 35)

Wyoming Welding Shop Serves Vast Territory—(Page 36)

What's New in Equipment and Accessories—(Page 37)

Trade Literature—(Page 40)

Commercial News—(Page 40)

Notes From the Field—(Page 42)

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INDEX TO ADVERTISERS

	Page
A	
Adams Co., J. D.	43
Air Reduction Sales Co.	16
Aladdin Rod & Flux Mfg. Co.	50
American Agile Corporation	49
American Arc Welders	49
American Brass Co.	39
American Steel & Wire Co.	Inside Front Cover
Anti-Borax Compound Co.	50
Arcos, Inc.	44
B	
Bastian Blessing Co., The	6
Braz-Weld Co.	50
C	
Carnegie-Illinois Steel Corp.	Back Cover
Central Steel & Wire Co.	Inside Back Cover
Champion Rivet Co.	50
Chicago Hardware Foundry Co.	43
D	
Dallett Co., The	44
Duralloys, Inc.	48
E	
Equipment Manufacturing, Inc.	46
F	
Faulk, F. R.	50
G	
Gulf States Steel Co.	12
H	
Handy & Harman	7
Harnischfeger Corporation	11
Harris Calorific Co., The	10
Hobart Bros.	3
I	
Ideal Face Shield Co., The	50
International Acetylene Ass'n	14 and 15
International Nickel Co.	18
L	
Lincoln Electric Co.	9
M	
Mallory & Co., Inc., P. R.	50
Metal Bond Mfg. Co.	50
Milburn Co., The Alexander	46
Milwaukee School of Engineering	50
N	
National Carbide Sales Co.	45
New Process Flow Welding Co.	44
O	
Owen Electric Mfg. Co.	45
P	
Piccadilly Hotel	46
Pierce Governor Co., The	45
R	
Republic Steel Corp.	1
Revere Copper & Brass Co.	32
Roebling's Sons Co., John A.	4
Ryerson & Sons Co., Jos. T.	42
S	
Safety Gas Lighter Co.	46
Sight Feed Generator Co., The	45
Steel Sales Corp.	47
Stoody Co.	Inside Back Cover
T	
Titan Metal Mfg. Co.	48
Torchweld Equipment Co.	47
U	
U. S. Steel Corp. Subsidiaries	Inside Front Cover and Back Cover
W	
Weldon Roberts Rubber Co.	46
Will-Weld Mfg. Co., Inc.	45

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EDITORIAL

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Will the Experienced Welder Meet the Challenge?

● The "experienced" welding operator faces a dilemma. Always, he has been accepted as the one to do the difficult or particular job. His superiority in technique, over the new man, was taken for granted.

Now the picture is changing. Some plate fabricators are turning to the welding schools for welding operators, claiming that the "experienced" man can't pass the tests.

It is easy enough for the old, experienced operator to vaunt his pride and charge the fabricator with personal animus. But that won't solve the problem nor help the situation of the operator.

One fabricating firm recently turned down about 60 welders having from 5 to 20 years' experience, because, it was claimed, they couldn't make tests that would qualify them.

The best schools recognize this situation and are training their students so they can pass the most stringent code tests. One school west of the Mississippi has 236 enrollments in its welding course, and almost all these students are clamoring for instruction that will enable them to pass tests for Class 1 or Class 2 vessel welding.

In an article in this issue, Mr. R. B. Lincoln points out that a welder who passes a test satisfactorily may a few months later be making faulty welds, entirely unconscious that a change in his technique has taken place. Rechecking shows up the fault and points the way to its elimination.

The experienced welder generally is prone to rest on his laurels. Can he meet the challenge thrown to him by the plate fabricator? Will he submit his work for testing and examination, and is he willing to accept the findings and to work toward a more perfect technique? If he isn't, he will find his services limited to second-rate shops and plants, while the younger generation of welders will be building the refinery vessels, pipe lines, and machine-base assemblies.

The "expert" holds his destiny in his own hands. He can meet the challenge successfully if he will. It means periodic testing and careful examination of the results, and —above all—a frank recognition that the purpose of tests is to show up faults so the welder can correct his technique accordingly.

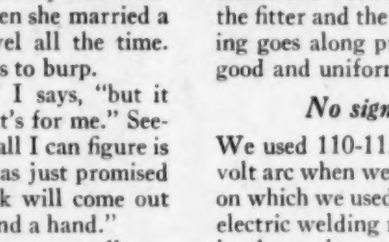
The welder whose work is not being checked periodically by a test program, can make his own coupons and have them tested and examined. Another suggestion would be to attend a good school under competent instructors for 2 weeks every year, or better, one week each six months. Such instruction should include careful testing and inspection of weld coupons.

By adopting such a program the experienced welder will likely have nothing to fear when he is confronted with a qualification test, however stringent it might be.

I'M just back from a hard trip, and staying awake one Friday night by request—listening to a lecture on happy married life by a lady who wonders was she crazy when she married a man who has to travel all the time. Then the phone begins to burp.

"Excuse me, Ma," I says, "but it sounds like maybe that's for me." Seeing it is nearly 1 a.x., all I can figure is one of our salesmen has just promised a customer that "Nick will come out in the morning and lend a hand."

And so, while I been wrong all evening up to now, this time it seems I'm right; although why salesmen always has to do things like that just about midnight is way beyond me.



Soooo, as the feller says on the radio, I get up in a couple of hours and goes out in the cold dark and starts up the old bus and drives halfway across a neighboring state to work with a bunch of boys that is engaged in welding a vacuum tank. She's the first of several they expect to turn out...cylindrical, 8 ft. in dia. by 8 ft. high, and she has to carry a nearly perfect vacuum. All-Monel Metal, and made of light gauge sheet, she is internally stiffened forty ways from the ace with both horizontal and vertical stiffeners inside the shell. They use about 200 lbs. of 1/8" and 5/32" No. 30 Monel rods per tank and each weighs about 3,000 lbs. when finished. Now here's a job that calls for real teamwork between the layout man, the fitter and the welder; for the welding goes along pretty easy if the fit is good and uniform.

No sign of fracture

We used 110-115 amps. with a 26-27 volt arc when welding the 5/32" sheet, on which we used 5/32" No 130Monel electric welding rod. The circle for the head was larger than could be made from a single sheet, so we have to make it by arc welding two 10 ft., 3/16" Monel Metal sheets. We welds the 10 ft. joint, grind it flush with the plate surface, and the boys presses it into a flanged and dished head. The weld metal comes through sweet—no sign of fracture, even at the knuckle of the head.

Well, to make a long story short, by putting in a little overtime we finishes up this first tank Saturday afternoon; and puts her under high vacuum for test. Naturally, I got to stay there to see how the test comes out, so after the boss welder and I spends a few hours together Saturday afternoon and evening I decides I'll stay right in town. So I puts up at the hotel and hangs one of these DON'T DISTURB signs on the doorknob. And, boy, it's nearly 3 o'clock Sunday afternoon when I finally come to. Im all made up on my sleep, and feeling like a 2-year-old. And of course the tank is all hunky dory, too, having not lost any of her vacuum.

• • •

Well, men, we just got time for a short one. Not a welding job, but what the heck. Many a sheet metal worker uses .031" to .050" Monel Metal for such jobs as tank linings. This is in a dye house, about as shown in my sketch.

We lock seams the joints—each of the two curved corners and two flush lock cross seams in the bottom—and make them ready for silver soldering by painting with Handy Flux. A No. 1 tip in a small oxy-acetylene welding torch is used to flow the Easy-Flo Brazing Alloy into the corner, using just enough of the silver solder to completely seal the joint. Because of the very low melting point (1175° F.) care must be exercised not to use too much heat. This silver soldered joint is a lot stronger than any soft soldered job. You'll find a lot of these Monel Metal dye tank linings made with silver soldered joints that are still as good as new after five and even ten years' hard service.

Here's hoping you are the same.

Nick Rodder

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Oxy-Acetylene . . . No. 43 Silicon Monel Gas Welding Wire.
Metallic Arc . . . INCO Monel Metal Arc Welding Wire No. 130.
Carbon Arc . . . INCO Monel Carbon Arc Welding Wire No. 20.

***for* INCONEL**

Oxy-Acetylene . . . No. 42 Inconel Gas Welding Wire. For flux see ** below.
Metallic Arc . . . Inconel Metallic Arc Welding Wire No. 32.

***for* NICKEL-CLAD STEEL**

(for welding of Nickel side)

Oxy-Acetylene . . . No. 41 Nickel Gas Welding Wire.
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* INCO Gas Welding and Brazing Flux for Monel Metal.
** "Cromalloy" Gas Welding Flux is recommended for Inconel.
No flux is used for the gas welding of Pure Nickel or Nickel-Clad Steel.

INCO welding materials as listed can most conveniently be obtained through regular INCO distributors.

Detailed welding instructions furnished on request.

The Welding Engineer

VOLUME 20 OCTOBER, 1935 NUMBER 10

Hard-Surfacing Dies and Punches

■ By J. B. AMES

HARD-SURFACING with the metallic arc has gone forward with great strides. This has been of distinct benefit to the manufacturer making stampings and punchings. Many expensive and intricate dies and punches would have to be discarded for new ones, were it not for the various good hard-surfacing electrodes that have been developed.

The application of these electrodes to hardened high-carbon and alloy steels presents a number of problems that need to be considered.

To repair a die or punch having a chipped cutting edge requires careful study by the welder to work out the best procedure. The metal must be clean, almost always some grinding is necessary. Before welding, it is best to try a bead on similar metal to make sure that the current setting is right, using reversed polarity. When your bead is sound and free from pin-holes then go ahead.

Executing a Perfect Cutting Edge

Where a perfect cutting edge is required, take a piece of sheet copper, about 22 gauge, and lay it flat next to the chipped edge. In this manner it is possible to lap your bead on the copper sheet without undercutting. You might get a slight copper alloying, but this does not seem to be serious.

On work that is thin with many piercing holes, it is very essential to copper plug the holes and back up the thin section with a heavy copper plate clamped tight. The copper dissipates the heat rapidly and spares untold distress to the grain structure of the steel.

There seems to be a constant battle between the mastery of man and the incorrigibility of steel. Man is always striving for perfection in grain structure of steel. Steel resents such treatment. If we would know how to handle steel right, we must think and learn—always keeping in mind that carbon tool steels must be kept cool. With the smaller-size electrodes, much lower currents are used—hence, less heat.

The Heat-Treat Man Also Has His Problems

The welder should develop a sense of sympathy for the heat-treat man. Suppose the latter is confronted with a tough job of hardening and tempering an odd-shaped die with a narrow neck protruding towards the center. In the quench, a tremendous strain is set up between the thin and heavy part of the die—perhaps some internal minute check has occurred. Even with a very slow draw this die will fail before it has done much work. When this die breaks, the welder has a problem on his hands: just how hard to make that neck—which rod to use, hard, medium or soft. It is well to remember that a low-carbon rod used on a high-carbon hardened steel will make a hard bead on one pass. In this case it would be best to blend for strength, toughness, and hardness. With practice, and the touch of a mill file, one soon learns to differentiate between the hardness of metals.

Having chatted with the heat-treat man, and not condemning him for a hard spot or bad check, we had better consider for a minute the tool-maker, who has to clean up our mess and grind the die to precision. The welder has much control over the tool-maker's job. He welds an inside corner which is impossible to grind. He can blend rods, making a semi-hard, tough metal that can be filed with a fine die-maker's file. Does that corner mushroom or crush away? To the contrary, it seems to work-harden and can take a lot of abuse.

Procedures for Various Types of Jobs

Let us consider what is to be done in the case of a small die broken into two halves. First, double-V it deep, then clamp it to a solid steel block with a slight shim under the break. With a high-tensile low-carbon rod, run one bead (work slow enough so you can place your hand on the work at any time), then turn and reclamp the die, and run a bead on the opposite side. Proceed in this manner, welding from one side then the other, and peening as soon as the metal will pack. This peening is mainly to relieve pulling strains, and must not be overdone. By this procedure the welder can control the straightness of the dies by the manner in which he applies his metal. The working edges are reserved to the last and are topped off with hard rod.

Perhaps the die broke off through several piercing holes. In that case, grind away the hard metal around the holes, insert low-carbon plugs, weld into place, and let the tool-maker do the rest by drilling and inserting hardened tubes for the piercing.

A long squaring punch from a power break might drop a piece from the center as big as your finger, caused possibly from a flaw or from hitting a double thickness of metal. A little plain steel sense tells us we can't weld a dip in a long, tough, hardened bar and expect to get away with it, unless we clamp the bar to a stiff I-beam, arch it slightly and proceed with a good low-carbon rod, peening as we progress, and reserving a slight depth for hard-surfacing finish.

Precautions to Be Observed When Altering a Die

Quite often in the making of new dies a change is made, or perhaps it's a mistake (a human weakness). The welder has to fill in an unwanted groove or pad up a corner. Remember that this steel is annealed and has to be hardened. It's to the welder's advantage to select several scrap pieces of the same

steel, weld on the pads, and let the heat-treat man harden them to check the results of the weld metal. Grind off any decarburized surface before welding to insure a true test.

A simple forming die is made from cold-rolled steel, with the corners hard-surfaced. Be sure to hard surface the sides where the punch slides; it will eliminate tearing.

In repairing cast-iron forming dies and punches, use a high-chromium, high-nickel rod, well flux coated. The rod metal does not absorb much carbon, and it retains its elastic qualities, thus giving a strong, shiny working surface.

Hard-Surfacing Precision Dies and Punches

Much can be said about hard-surfacing precision dies and punches, and yet many welders have their pet technique about certain jobs of this kind. However, high-carbon steel is high-carbon steel and should never be worked too hot, neither should a cold die be welded. It is better to heat to about 150° or 200° F. before welding; it eliminates checking in the bead to a great extent. Do not worry if your die blues adjacent to the weld; perhaps it was a little too hard anyway. It seems that steel goes through a self-hardening cycle, either by work or age. You, no doubt, have seen a chain link break without losing its shape, showing that sparkling, fine grain. Yes, it had hardened by use and age.

Avoid Use of Water As a Cooling Agent

A little word about hard-surfacing and water while welding: they do not mix. Save yourself a lot of trouble by using a milder cooling agent — air. Water sprinkled on a hot die will cause bottom checks and will anneal the "blue" bordering the welded bead.

Many think that because they heat a piece of tool steel to 1400° or 1500° F. and toss it into a corner, they anneal that piece of steel. With such treatment, almost always some very hard structure sets itself up within the steel, because it was allowed to pass through the set of different grain structures. Had that same piece been heated to the critical zone, allowed to cool to a dead black, then quenched in water, it would be fairly soft because it would have been checked in a grain zone not so hard. This is not mentioned as a method for annealing tool steel, but rather a tip to ward off trouble for the welder of dies, punches, or other hard parts.

Technique With Slag-Producing Rods Requires Careful Study

Almost all hard-surfacing rods have a heavy coating or covering which forms a slag to protect the metal through the fluid stage. This slag is pesky and troublesome, and a technique must be studied to lay solid metal down underneath the slag. Quite often it is necessary to tilt the work at some certain angle to allow the slag to flow back over the bead. Before welding a second time, chip off all slag and steel-brush the bead. If there are slag inclusions, grind them out before welding further.

With small rods, low amperage is necessary. Many arc-welding machines lack the low range. In that case, a resistor with taps or rheostat is required, with which arrangement any current between the taps can be had by changing the amperage at the welding-machine dial. It is very important to obtain the correct current for hard-metal welding. With little experimenting, that can soon be learned.

Don't Break the Arc Too Quickly

On striking or breaking the arc, it is necessary to hesitate long enough to deposit enough metal to avoid pits. In breaking the arc, do not jerk the rod away, but pull it off gradually. Breaking fast makes deep pits in the crater.

When one must use low-carbon rods, avoid the fast, deep-penetrating heavy-coated rods; high-carbon steel goes to pieces under such a hot crater.

Much has been accomplished in the last ten years, but with the rapid progress being made in developing high-speed alloy steels, much is still to be done to make better rods and to educate the welder to apply these new rods the best way.

Los Angeles Section Starts Fall Activities

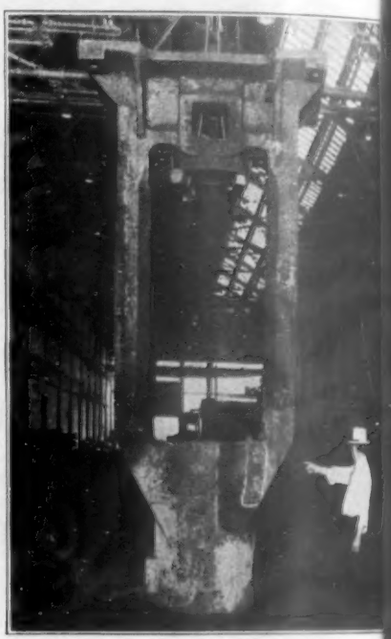
The scheduled program of the Los Angeles Section of the American Welding Society, held on Oct. 17th, consisted of a talk by Grover Hubble, electrical engineer, on a. c. welding, including entertainment in the form of "electro-magic", covering interesting phases of the electric phenomena of welding, as well as a talk by R. L. Graves, welding inspector for the Union Oil Co. of California, on training welders for oil-field work, principally pipeline jobs. Also, Chester Mott, of the Stoody Co., was to discuss the self-sharpening method of increasing the life of abrasion-resisting tools.

The feature of the Section's meeting on Sept. 19th was a visit to the new building of the *Los Angeles Times*, which was so built as to withstand earthquake shocks, and contains some welding in its construction. Talks were made by the following men, who had important positions in the building of the structure: R. H. Crawford, associate architect of Gordon B. Kaufman, architect of the building; Fred Walker, of the P. J. Walker Co., general contractors; Harold F. Uttley, of the Consolidated Steel Corp.; and Murray Erick, structural engineer.

Repairs Steel Casting by Thermit Process

A 30,000-lb. steel casting on a hydraulic press of 4,000-lb. capacity, used for the extruding of copper tubing, developed a crack about 30 in. long at a point where the casting section was 6 in. thick. The repair was made by the Thomas Welding Laboratories, Inc., 15120 Woodward Ave., Detroit, Mich., using the thermit process.

The crack was grooved out to a width of about 1½ in. with a cutting torch.



4,000-Lb. Casting With Thermit Repair

The groove was prepared for welding by waxing the surface, building the mold and, finally, preheating for 18 hours. The illustration on the front cover of this issue was taken immediately after the thermit was ignited, with the crucible in place over the mold surrounding the break. The finished weld is shown in the illustration on this page, the casting being upside down, which is the position in which it was welded.

Deaths of Two Noted Europeans

The deaths of two men prominent in the welding industry overseas have been announced in recent months. One of these is Charles Henry Bingham, Sr., well-known manufacturer of calcium carbide and writer on the subject, whose death occurred in England on August 15th, and the other is Dr. Kurt Baumgartel, publisher and editor of *Elektroschweissung*, who died in Braunschweig, Germany, on July 23rd.

Institute of Welding (British) Announces Winter Program

The winter session program of the North-Western Branch of the Institute of Welding, Manchester, England, has been announced as follows: Sept. 25th, "Gas Cutting of Metals Prior to Fabrication and Welding," by W. Hart; Oct. 23rd, "Development of Electric Welding Equipment," by Dr. J. H. Paterson; Nov. 27th, "Welding Jigs and Fixtures," by J. A. Ashworth; Jan. 22nd, "Welding as Applied to Steel-Framed Buildings," by G. Ramsey Moon; Feb. 26th, "Welding and Works Production," by G. A. Mozley; Feb. 29th, annual dinner and dance; and Mar. 25th, "Development of Atomic-Hydrogen and of Oxyacetylene Welding," by J. A. Dorrat. All meetings will be held in the Manchester School of Technology.

Forum and Drama Will Feature I.A.A. Convention

Among the high-lights of this year's annual convention of the International Acetylene Association, is an evening session which will take on the aspects of a forum on welding and cutting problems. Also, the play "Profits of Progress," which drew large crowds at last year's convention, will be given a single performance.

As an accommodation to those visitors who have sales conferences or other matters to attend to, there will be no morning sessions, except on the opening day of the convention.

The program, which appears below, covers a wide variety of topics, such as safe practices, metallurgy of welding and cutting, and application to piping and pressure vessels, and to the railroads. All sessions are followed by discussion periods.

Program of Annual Convention, International Acetylene Association

Cleveland, Ohio, November 12th to 15th

All sessions to be held in the Grand Ball Room, Hotel Cleveland, unless otherwise noted.

Tuesday, November 12th

9 a. m.—Registration.

10 a. m.—Opening Session. Chairman, President Philip Kearny.

Address of Welcome, by Dr. W. E. Wickenden, president, Case School of Applied Science.

Keynote Address, by Merle Thorpe, editor, *Nation's Business*, Washington, D. C.

President's Address, by President Philip Kearny, New York.

"Twelfth International Acetylene Congress, London, 1936," by A. Bede Harrower, The British Oxygen Co., Ltd., London, England.

"Acetylene in the Chemical Industry," by A. F. G. Cadenhead, chief of plant research department, Shawinigan Chemicals Industry, Ltd., Shawinigan Falls, Quebec, Canada.

Presentation of Morehead Medal, by H. B. Pearson, past president, International Acetylene Association, Chicago. (Recipient not yet announced.)

2 p. m.—Safety. Chairman, Lee Skeel, Judge of the Common Pleas Court, City of Cleveland. Vice-Chairman, James I. Banash, past president, National Safety Council, and consulting engineer, International Acetylene Association, Chicago.

Reports of Legislative and Insurance Committee and of the Technical and Engineering Committee, by H. S. Smith, chairman, Executive Committee, International Acetylene Association, New York.

"Prevention of Welding and Cutting Fires," by C. D. Abbott, district manager, Associated Mutual Fire Insurance Companies, Cleveland.

"Safe Handling, Storage and Return of Compressed-Gas Containers," by F. R. Fetherston, secretary, Compressed Gas Manufacturers' Association, New York.

"Studies in Industrial Health of Interest to the Oxyacetylene Industry," by W. P. Yant, superintendent, Experiment Station, United States Bureau of Mines, Pittsburgh.

Discussion, by Dr. Frank S. Rossiter, company surgeon, Carrie Furnaces, Carnegie Steel Co., Pittsburgh, and F. Eder, Robert W. Hunt Co., New York.

8:15 p. m.—"Profits of Progress," an industrial drama in four acts, by Wilfred P. Burglund. Music Hall, Civic Auditorium, 6th St. and Lakeside Ave.

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Wednesday, November 13th

2 p. m.—Metallurgy of Welding and Cutting. Chairman, A. E. Gibson, vice-president, Wellman Engineering Co., Cleveland. Vice-Chairman, J. J. Crowe, president, American Welding Society, and engineer in charge, Apparatus Research and Development Department, Air Reduction Sales Co., New York.

"Welding and Cutting of High-Chromium Steels," by W. J. Priestley, vice-president, Electro Metallurgical Co., New York.

"Further Studies of Oxyacetylene-Cut Steel Plate," by Prof. J. H. Zimmerman, Massachusetts Institute of Technology, Cambridge, Mass.

"Hydrocarbon Fuel Gases for Cutting," by Dr. George Slottman, Air Reduction Sales Co., New York.

"Gas Welding Aluminum and Its Alloys," by G. O. Hoglund, supervisor of welding, Aluminum Co. of America, New Kensington, Pa.

Discussion, by Dr. J. C. Hodge, The Babcock & Wilcox Co., New York; Prof. Bradley Stoughton, in charge, Department of Metallurgical Engineering, Lehigh University, Bethlehem, Pa.; and E. E. Thum, editor, *Metal Progress*, Cleveland.

8:15 p. m.—Welding and Cutting Forum. Auditorium, The Brotherhood of Locomotive Engineers, 1370 Ontario St. Presiding, William B. Browning, The Linde Air Products Co., Chicago.

Part I—Speaker, Dr. A. B. Kinzel, chief metallurgist, Union Carbide & Carbon Research Laboratories, Inc., and chairman, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers, New York.

Materials Used in the Oxyacetylene Process: Their production, qualities and uses.

Oxyacetylene Cutting—Theory and Practice: Hand cutting, machine cutting, and the oxygen lance.

Identifying Metals to Be Welded.

Demonstrations and Explanations of Certain Recent Welding Techniques.

Part II—Speaker, James I. Banash, past president, National Safety Council, and consulting engineer, International Acetylene Association, Chicago.

Safe Practices in Using the Oxyacetylene Process.

Part III—Speaker, John J. Crowe, president, American Welding Society, and engineer in charge, Apparatus Research and Development Department, Air Reduction Sales Co., New York.

Testing Welds and the Welded Structure.

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Thursday, November 14th

12 noon—Annual Luncheon and Business Meeting, for members and guests, Hotel Cleveland (location to be announced). Chairman, President Philip Kearny.

Reports of Oxyacetylene Committee, consulting engineer, secretary, treasurer, Auditing Committee, Membership Committee, Resolutions Committee, and Nominating Committee. Election of officers.

2 p. m.—Piping and Pressure Vessels. Chairman, Dr. D. S. Jacobus, advisory engineer, The Babcock & Wilcox Co., New York. Vice-Chairman, F. C. Fantz, vice-president, Mid-West Piping & Supply Co., St. Louis.

"High-Pressure Piping," by J. A. Freiday, mechanical engineer, Thos. J. Murray, Inc., New York.

"Welding Class I Pressure Vessels," by G. W. Plinke, director of research, Henry Vogt Machine Co., Louisville, Ky.

"Welded Piping and Pressure Vessels in the Marine Field," by J. W. Wilson, engineer, Bureau of Navigation and Steamboat Inspection, Department of Commerce, Washington, D. C.

"Permanency of Oxyacetylene Welding," by F. C. Hutchinson, engineer, The Linde Air Products Co., Kansas City, Mo.

Discussion, by E. R. Fish, chief engineer, Boiler Division, Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.; Charles E. Gorton, chairman, Administration Council, American Uniform Boiler Law Society, New York; and T. W. Greene, chairman, Power Piping Code Committee, American Welding Society, New York.

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Friday, November 15th

2 p. m.—Transportation. Chairman, G. D. Brooke, vice-president, Chesapeake & Ohio Railway Co., Cleveland, Ohio. Vice-Chairman, Lem Adams, chief engineer, The Oxweld Railroad Service Co., Chicago, Ill.

"Maintenance-of-Way Problems in High-Speed Transportation," by Armstrong Chinn, chief engineer, Chicago & Alton Railroad, Chicago.

"Oxyacetylene Process in Maintenance-of-Way Work," by L. J. Turner, chief rail inspector, The Chicago, Rock Island & Pacific Railway Co., Chicago.

"Shape Cutting of Locomotive and Car Parts," by James Grant, superintendent of motive power, Atlantic Coast Lines, Waycross, Ga.

"Economic Advantages of the Oxyacetylene Process to Railroads," by Geo. Durhan, vice-president, Wheeling & Lake Erie Railroad, Cleveland.

Discussion, by Elmer T. Howson, vice-president, Simmons-Boardman Publishing Co., Chicago, and B. F. Kuhn, assistant superintendent of motive power, New York Central Lines, Cleveland.

Some Notes on Preheating and Contraction and Expansion...

■ By F. E. TOTTEN

THE equipment and the procedure employed play a large part in doing good work when welding. Let us consider, first, some of the equipment necessary for good work.

In addition to good welding apparatus and first-class rods and fluxes, we need a power grinder or emery wheel and a lot of small tools such as hammer, chisels, gouges, etc. In addition, we need a number of parallel strips and C-clamps ranging in size from the small ten-cent-store kind to the heaviest obtainable. A drill press and small lathe are also desirable.

Another highly useful piece of apparatus is the Bunsen burner (See Figs. 1 and 2). These operate on the principle of the housewife's gas-range burner and are useful for keeping up expansion when produced by a larger burner or for preheating very small pieces. These can be made of scrap pipe right in the welding shop. They require natural or artificial gas for their operation. If the shop does not have gas, an oil burner can be used for a preheating torch, but it will not operate a Bunsen burner.

When metals get hot they expand and they continue to expand as the temperature goes up. Also, as cooling takes place, they shrink. In the case of weld metal, this expanding and contracting is at right angles to the direction of the weld. If the weld is made on one side only of the welded piece, that side will draw up, due to the larger amount of metal on that side. Practical use can be made of this phenomenon, as noted in Figs. 3 to 8. This drawing-up can be prevented by the use of parallel strips and C-clamps.

After grinding or chipping the part where broken (be sure not to grind it all the way across like a chisel, but leave the edges or corners untouched as matching points, as shown in Fig. 9), place the machined surfaces, if any, on the parallel strip and clamp securely with the clamps. This will allow the part to expand under the heat but will prevent it from bending or buckling while expanding or contracting. If it is necessary to weld on both sides of the break, the part will have to be held up off the parallel strip by means of shims high enough to allow for welding under the strip. Keep the reinforcement as nearly uniform as possible on both sides, as this will equalize the draw and help hold it straight.

If it is not possible to clamp up a job as above described, be sure always to build up on both sides even if reinforcing is not desirable or permissible on one of the sides. After the job is cold, the unwanted reinforcement can be removed, as it will have served its purpose in keeping the job straight. Removing the excess metal after the job is cold will not affect its alignment.

If, as mentioned in the foregoing paragraph, the job cannot be clamped to hold it in line, and if building up on both sides of the V is required and the piece is of fairly heavy section, the procedure must be modified somewhat to insure its alignment. Fill the first V up half way only, then turn the piece over and completely fill that V, reinforcing, if desired, then turn it over and finish the V started first, reinforcing, if desired or necessary.

The weld around a hollow shaft should be quartered—that is, weld one-fourth way around, jump 180° and weld another fourth way around, then back 90° and weld and back 180° and weld. This will balance up the drawing action of the weld metal.

A casting that cannot be clamped to hold it in line should be handled in this manner: Select four points on the broken edge of each half and grind out all the metal between these points. Then

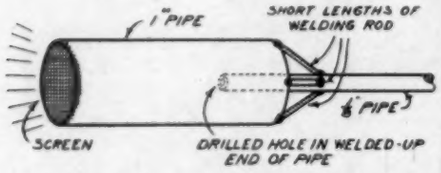


Fig. 1. Showing Construction of Simple Bunsen Burner.

(This simple Bunsen burner consists of a piece of 1-in. pipe about 6 in. long. A piece of ⅛-in. pipe is then welded shut on one end. Be sure to weld as deep down as possible. Then drill a ¼-in. hole in the approximate center. This small pipe should be of a suitable length, and threaded on one end for a valve. It is then welded concentric to the larger one after inserting a short distance in one end as shown. Short lengths of ¼-in. welding rod welded to the large pipe and the small one leave plenty of room for air to enter at this point. The far end should be covered with a light iron screen, thus causing the flame to burn away from the pipe.)

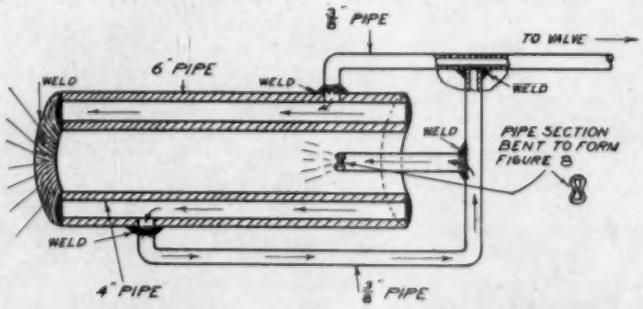


Fig. 2. Larger Bunsen Burner for Preheating.

(This burner is satisfactory for preheating, especially if the city-gas pressure is high enough. This can be made of pipe sizes to suit one's taste. The burner pipe, or the pipe where the gas leaves the circulating system, is usually mashed down to produce a hole shaped like a figure 8. This gives a fan-like flame. The gas passing through the burner is highly heated and burns rapidly on leaving the burner pipe. The writer has used a larger-size burner of this type to heat such objects as a locomotive frame, mine car and locomotive axles.)

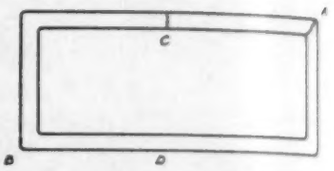


Fig. 3. A Simple Example of Preheating to Compensate for Contraction.

(If broken at *A*, heat at *B*. If broken at *C*, heat at *D*.)

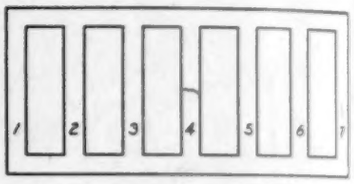


Fig. 4. A More Involved Case Requiring Preheating.

(It is necessary to place burners under 1, 2, 3, 5, 6 and 7 when welding at 4. Other combinations are readily seen if some other section than No. 4 is broken. These are usually necessary, even if the entire casting has been preheated, in order to hold up the expansion during welding. When the welding is completed, leave burners under all sections until the welded section is the same temperature as the unwelded sections.)

when the half (usually the lighter half) is placed on the heavier or lower half, it should touch on the four points only. Preheat before tacking at any point. This is desirable because the part might shift during heating and if tacked it would be impossible to realign it. After it is preheated and is perfectly in line, tack between the matched points but never on these points. This is because the melting or softening of the matched points by the flame might cause the part to lean on one side and move out of alignment. Weld on alternate sides to equalize the draw of the weld metal. The tacking between the matched points will have a tendency to draw these points together with heavy pressure and prevent their moving during welding.

Sometimes, as when welding an included crack, it is necessary to remove all the metal along the broken edges. Then the question arises as to how much expansion to create before welding so as to leave no stresses in the weld. Cast iron should never be preheated above a dull red. Enough expansion should be produced that when the joint is brought to the welding heat the edges of the joint will just touch. If they touch before welding heat is reached, then there is not enough expansion; and if they do not touch when the joint is ready to weld, there has been too much expansion produced. In the first instance, preheat a while longer, and in the second instance remove the preheating medium until cooling has taken place to the point where the joint checks with the above rule.

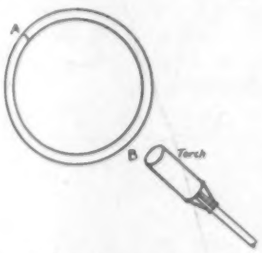


Fig. 5. Preheating a Ring to Prevent Flatness.

(Heat should be applied and held at *B* during welding of crack at *A*, otherwise the ring will be flat at the point of welding.)

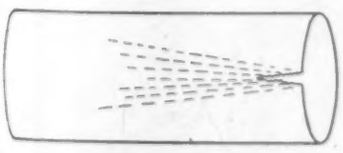


Fig. 6. Method of Preheating Cracked Cylindrical Object.

(It is only necessary to heat the areas shown by the broken lines, in order to produce expansion at right angles to the direction of the weld.)

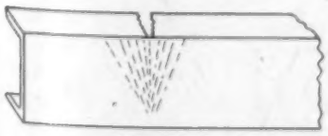


Fig. 7. Automobile Frame With Fracture in Top Flange.

(To weld this frame without using a patch, heat as shown by the broken lines to produce expansion to compensate for the contraction of the weld. If the break is in the bottom flange, the fan-shaped heated area should be inverted.)

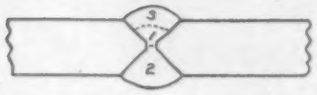


Fig. 8. Sequence of Welding of Shaft.

(By following the sequence of welding shown, the shaft or other object is not pulled out of line by the draw of the weld metal. This is particularly important if the weld is of considerable thickness.)

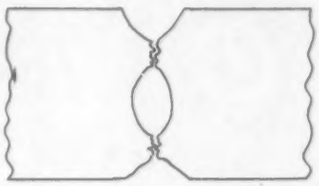


Fig. 9. Casting Ground or Chipped Out, Having Four Matching Points.

(After all the material at the joint is carefully removed, except at the four matching points, one half is placed on the other half and is held in position by its own weight. It is then preheated, if preheating is necessary, and is then tacked at points other than the matching points, usually half way between the matching points.)

All the above descriptions center around what I call Rule No. 1, which is stated in this manner: "Shrinkage is usually at right angles to the direction of the weld, therefore expansion should be produced at right angles to the direction of the weld to compensate for the shrinkage."

Oxyacetylene Association Revises Its By-Laws

The National Oxygen and Acetylene Association, at a meeting held in Chicago on Oct. 9th, unanimously concurred in a recommendation of the Board of Directors that the Association be continued and that its by-laws be amended to carry forward the organization of the industry effected in August, 1933.

The revised by-laws, which were unanimously approved by the general meeting, divides the industry into three divisions: Commercial-Gas Division, Apparatus Division, and Medical-Gas Division.

Trade-practice provisions for the Commercial Gas Division were approved by this division at the general meeting. The Board of Directors recommended that each of the remaining two divisions continue their membership in the Association and submit suggestions for trade-practice provisions for consideration and adoption by these respective divisions.

Directors elected for the ensuing year are: O. E. Engler, P. B. Francis, C. D'W. Gibson, W. C. Keeley, S B. Kirk, E. L. Mills, J. H. Rodger, R. B. Swope, G. B. Walker and D. J. Will.

C. A. McCune Receives Miller Memorial Medal

The recipient of the Samuel Wylie Miller Memorial Medal for the year 1934 is Charles Andrew McCune. The presentation was made by F. T. Llewellyn, chairman of the Board of Trustees in charge of awarding the medal, at the Fall Meeting of the American Welding Society, Sept. 30th, in Chicago.

This memorial, established by S. W. Miller in 1927, is awarded each year in recognition of valuable service to the advancement of welding and cutting.

Mr. McCune's connection with the welding industry goes back to the early days of the use of the process in this country. In 1904 he was with the Commercial Acetylene Co. as assistant engineer, later becoming chief engineer. In 1916 he became sales engineer with the Page Steel & Wire Co., which led in 1924 to his assuming the position of Director of Research of the American Chain Co. Six years later he aided in the formation, and became Director of Research, of the Welding Engineering & Research Corp. Following the dissolution of this corporation, he assumed his present position as director and secretary of the Magnaflux Corp., of New York City.

CHARLES A. MC CUNE

Mr. McCune played a leading part in the development of cylinders for the safe storage and transportation of acetylene. He made valuable investigations and reports on welding rods and electrodes. As a member of the Emergency Fleet Welding Committee during the World War, he was chiefly responsible for the crystallizing of specifications for these products.

He is one of the founders of the American Welding Society, and a past president. Since 1923 he has served as treasurer of the Society, and has also given much time to committee work. He has also taken an active interest in the International Acetylene Association, and is a past president of that organization.

Controlling Welding in the Structural-Steel Fabricating Shop

■ By ROBERT E. KINKEAD
Consulting Engineer

BUT for mishandling of the situation, the steel-plate-fabricating industry might have profited from the application of welding, says Mr. Kinkead, in this talk delivered before the 13th annual convention of the American Institute of Steel Construction, at White Sulphur Springs, W. Va., on Oct. 17th. Some ways are pointed out by which the Institute can assist in controlling the situation, as regards welding, for the benefit of the structural-steel fabricators, thus avoiding the evils that were the lot of the plate fabricators.

IN manufacturing industries where fabrication is carried out under the manufacturer's own specifications, use of welding has, in many cases, resulted in very substantial profits. Candor compels me to admit that in the fabricating industries where customer's specifications prevail, welding has resulted in advance of the art but not in substantial profit to the fabricator.

If we are to talk about control of welding in the structural-steel-fabricating industry, it seems to me that it is right and reasonable to begin at the beginning and talk about control of profits. Welding practices are changing the fabricating business now; the changes are likely to come faster and involve more capital outlay from now on. The situation is not unprecedented. We have seen the steel-plate fabricators, in the last 20 years, go from practically all-riveted construction to practically all-welded construction. The steel-plate-fabricator's business is similar to the structural-steel-fabricator's business in that the work is done, in most cases, to customer's specifications. The welding industry has profited very largely by this change. The steel-plate fabricators have not profited by the introduction of welding into their business except in a few isolated cases. I do not believe that there is a single plate fabricator in this country that could, in any three-year period, take profits out of his business equal in amount to the money he spent for welding and cutting equipment and supplies.

Drawing a Moral From the Experience of the Plate Fabricators

I do not see how we can consider control of welding in the structural-steel-fabricating business without recognizing the experience of the steel-plate fabricators. There must be some reason why the welding industry made money from the plate fabricators and the plate fabricators acted as merely profit collectors for the welding industry. There are plenty of reasons for this state of affairs and they stand out like the nose on a man's face.

The welding industry found out very early in the game that its job was to sell welding to the steel-plate-fabricator's customer. That forced the fabricator to do welding whether he wanted to or not. The fabricator lost control of his business completely. As soon as either the fabricator or the welding industry found a new and better way of doing a job, the welding industry sold the scheme to the fabricator's customer, and the fabricator had to adopt it. Salesmen, circulating among the competing shops and reporting to central sales offices, were in possession of a great deal more information about the steel-plate-fabricating industry than any member of the industry itself and used that information profitably.

Another way in which the steel-plate fabricators yielded control of their business to the welding industry was that the steel-plate fabricators, with a few exceptions, have never had any very clear idea of what a weld should be like, what it ought to cost, or what kind of service behavior should be expected of it. About all the steel-plate fabricator knows about the welding business is what ten or fifteen salesmen tell him, and that kind of testimony is so conflicting that it is often wholly unreliable. The fabricator would have been better off, in most cases, to have believed one salesman who was half right than to try to coordinate and evaluate the stories of ten or fifteen competing salesmen.

Now I do not wish to convey the impression that the steel-plate fabricators are incompetent business men. Most other similar industries have made the same blunders. They overlooked the importance of welding. In their case, we are dealing with second sight. But the structural-steel fabricators seem to be about to travel the same course; and if there are any conclusions to be drawn, the time to draw them is now—not after the damage is done.

Suggests A.I.S.C. Act as Information Center

It seems reasonably obvious to me that the collective purchasing power of the members of the Institute is a sufficiently powerful influence to control the welding industry's activities with the fabricator's customers. It does not seem beyond the bounds of reason that the Institute can furnish its members with information about welding which will be accurate and authentic so that the members need only to rely on the welding salesmen for information about their equipment and supplies. Further, the lookouts of the Institute can warn the members several years in advance of probable changes in the requirements for welded construction so that their affairs may be conducted on a sound basis and they will not be disturbed by conditions about which they had had no previous warning. The welding industry usually knows, and the Institute can find out a year or two in advance, where new applications of the process will be made.

These matters are not difficult to handle in the interest of the fabricators. Yet they are matters which if successfully handled will not keep a good business man in the fabrication industry from making more money than a poor business man. The result of successful handling of these matters will mean simply that the structural-steel fabricators will not become merely profit collectors for the welding industry. The control of the situation is a vital necessity because the fabrication business is largely a matter of fastening pieces of metal together—and that is what welding is used for.

Technical Control Is Also Needed

I now wish to deal with the technical side of the matter of controlling the welding in the fabricating business. It seems to me that again we have a parallel in the steel-plate business. Here we found that one fellow, making poor welds that cost one-third as much to make as good welds, would compete with

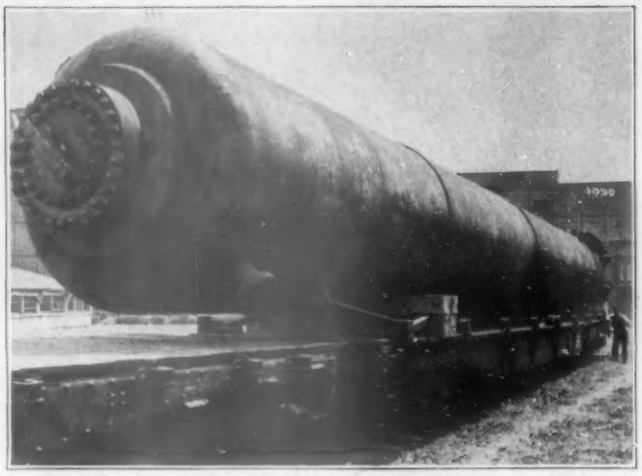
another fabricator who was doing the job the way it ought to be done. The tendency was to drag everyone down to a common level of low price and inferior workmanship and engineering. While we do not know any perfectly certain way of improving human nature, we do know some ways of making it difficult for the ignorant and the dirty-trick boys to get away with their schemes. No one has yet discovered a substitute for putting the right kind of weld metal in the right place and in sufficient quantity to do the job expected of it. It has been our practice to specify welds in common use, giving in detail the loading that can be applied to them and also giving their minimum dimensions, method of preparation, etc. Now one fabricator might make such a weld five times as fast as another, but the customer would get what he needed and what he paid for in either case. The thing I am talking about, of course, is nothing more than what you have found necessary in the case of riveting, the loading of structural members and other details of your business.

The repair and alteration of existing structures by use of welded connections involve highly specialized knowledge and I am of the opinion that the Institute should be your source of authority for such work. Aside from the legal responsibilities involved, the work belongs to the fabricators and the best way to prevent encroachments of others is to put the weight of authority of the Institute in the balance on the side of the fabricators.

New Fields for the Fabricating Shop to Conquer

In the field of technology lies also the job of finding new work for the fabricators to do. Every year there are hundreds of new applications of welding made to metals. In many cases, the welding on these new applications is work that the fabricator could do better than those who actually execute the work. The fabricator could get the business over the telephone if he were properly informed on what is going on. It is an indisputable fact that hundreds of manufacturers are making welded structural-steel assemblies in their own plants when they could buy them from a fabricator for half the price. It is a technical task to separate the jobs the fabricator can do profitably for less cost than the manufacturer.

Now I am not so young and inexperienced as to believe that the Institute can become a guardian angel that will keep all of its members in happy prosperity and contentment in all matters involving welding. But I do believe your Institute can work out a program of cooperation based on common sense which will greatly mitigate the evils that have fallen on the steel-plate fabricators due to their mishandling of the welding situation. The process by which you fasten pieces of metal together is the most vital part of your business. When, if, and as this vital part of your business passes out of your control, you become collectors of profit for someone else. Of course, it is true that under present conditions you probably rivet five hundred tons of steel for every ton of steel you weld together. But then, by the time the ratio is reversed and you are welding five hundred tons of steel to every ton you rivet, the problem will have disappeared and you will be controlling your own business and operating it for your profit, or the welding industry will be using you as collectors of their profit.



All-Welded Water-Scrubber 73 Ft. Long, Built by the Treadwell Construction Co.

Contracts Awarded for Welded Pipelines

Two contracts for arc-welded pipelines were recently awarded H. C. Price, Inc., of Bartlesville, Okla., and a third contract has just been announced by the San Francisco office of this firm.

One of these lines will consist of approximately 18 miles of pipe in sizes of 6, 10, 12 and 16 in., for the Phillips Petroleum Co. in Moore County, Texas, construction on which has already started. The J. R. Stewart Construction Co., of Oklahoma City, are the general contractors.

There is also approximately 65 miles of 12-in. and 56 miles of 10-in. line in Wyoming and Nebraska being welded for the North Central Gas Co., the general contractors being Williams Bros., Inc., of Tulsa.

The third contract, which is also under way, involves the arc welding of approximately 45 miles of 22-in. gas line for the Pacific Gas & Electric Co., running from Milpitas to San Francisco. The Youdall Construction Co., of San Francisco, are the general contractors.

Plate Fabricator Reports Four Months' Work Ahead

Approximately 450 men are being employed at present by the Treadwell Construction Co. of Midland, Pa., manufacturers of welded steel plant and river-harbor steel floating equipment, and their plant is unusually busy at present, according to Bayard W. Hunsicker, vice-president, who told a representative of *The Welding Engineer* that the company has orders booked ahead for four months' work.

The company recently turned out some mammoth units of welded steel construction. Chief among these was an arc-welded steel water scrubber, illustrated herewith. This huge scrubber, which was tested to 500 lb. pressure and built for export, was 8 ft. in diameter and 73 ft. long. It was built of 1- and ⅞-in. plate and weighed 72 tons, requiring two railroad flats on which to load it.

Many other large welding installations have been completed recently by this company. One order called for 19 welded tanks, each 10 ft. 11 in. by 8 ft. 1 in. by 12 ft. 10½ in. Another included two steel acid tanks, 11 ft. in diameter by 61 ft. in length.

Mr. Hunsicker points out that there is a noticeable swing toward welded equipment. Commenting upon the industrial outlook, he says:

"Industry as a whole has traveled a long journey from the methods of a decade ago to those of today. With these changes has come, also, a sharply felt need for equipment of different character or larger capacity. In many cases this matter of re-equipment is more or less an optional matter, but in many others it amounts to a strict necessity, enforced by the requirements of new methods, or by competition. We are thinking, of course, of our own field—heavy steel plate equipment—a field in which we have kept our facilities abreast of every development."

Inexpensive Weld Tests . . .

■ By R. B. LINCOLN
Director, National Weld Testing Bureau

GOOD welding is difficult without a systematic program of weld testing, because when no tests are made the welder has no chance to see and correct his mistakes. He is like a man shooting at a mark without knowing whether he is making "bulls' eyes," shooting too high or too low. Even when welders have been held to a high standard of quality by systematic testing, if it is discontinued some of them may fall into bad habits. In the writer's experience they usually tend to develop a good external appearance of the weld, but fail to secure complete fusion. This is apparent at once when such a group is subjected to qualification tests.

Many shops do not feel that they can afford the cost of weld tests. They point out that weld failures in the past have been infrequent and have resulted in little or no less, so that if all, or nearly all, failures could have been avoided, the saving would have been small. However, if they are "skating on thin ice," due to lack of testing, failures may occur in the future, and one failure may result in losses exceeding the cost of testing for years. A case of this kind came to the attention of the writer—the welds on a small angle-iron bracket failed, allowing it to fall into rotating parts of the machinery and causing several thousand dollars of damage.

Use of Over-Size Welds Indicates Lack of Confidence

Savings may frequently be effected by a program of weld testing. The improved quality permits the use of smaller welds worked at higher stresses, and at the same time assures greater safety. Some design engineers regularly specify double the amount of welding required by calculations, "to be on the safe side." Inquiry will usually show that the practice has been caused by some unfortunate experience which the designer has had with defective welds in the past.

It costs less to secure safety by controlling the quality through adequate tests and supervision, than to get the same safety by using an excessive amount of welding. A good program of weld testing adds a small amount to the total cost of welds, while the other practice adds 50% to 100%.

The qualification tests required by the various codes sponsored by the American Society of Mechanical Engineers and the American Welding Society leave little room for improvement, so far as safety is concerned. When the highest quality of work is required, these codes should be followed, whether mandatory or not, for the sake of safety, as, for example, on pressure vessels, where a weld failure might result in personal injury or serious property damage.

Simple Test Program May Also Be Used as Preliminary to Code Tests

A simple and inexpensive program of weld testing, that will be satisfactory where conditions are not severe enough to justify the cost of code tests, is suggested below. It is also useful as a preliminary to the code test. It serves to indicate what welders are likely to pass the code test and what additional training others require. By following the suggested plan, repetition of the more costly tests, due to failure to qualify the first time, will be avoided.

Test specimens should be of approximately the same thickness, kind of material and type of joint used in construction. On the other hand, they should be varied, to avoid the welders' becoming expert in making the specimens without acquiring a corresponding skill in making production welds.

Several different types of specimens are suggested, so that by varying the welding positions and using two or three different thicknesses, covering the range usually used in the shop, a program can be worked out that will last a year, before repetition is necessary. If preferred, pipe may be substituted for plate.

In a previous paper* it was pointed out that experience shows that failure to pass the qualification tests for "Class 2" welds is usually due to porosity or incomplete fusion. This is equally true of practically all the qualification tests required by the various specifications and codes in common use. Fracture tests serve to disclose such defects. They are inexpensive and can be made without special apparatus.

There will be little difficulty with tension or bend specimens, if sound welds are produced, using the correct grade of filler metal, because any deviation from correct procedure that will lower the strength or ductility of the weld metal will also cause porosity or incomplete fusion. The only exception to this rule that has been observed is the incorrect adjustment of the oxyacetylene flame.

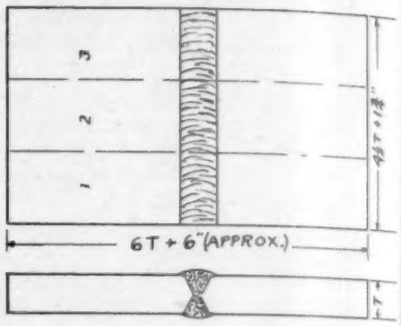


Fig. 1. Welded Plate Before Cutting Into Nick-Break Specimens.

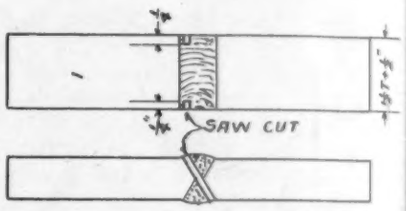


Fig. 2. Fusion-Zone Nick-Break Specimen.

When fracture tests are used, without tension or bend tests, it is better to make one or two specimens once a month than to make a more extensive test once a year. The short time required by each welder to make his specimen (about one-half hour) can be absorbed without upsetting the production schedule. Further, if a welder who has been doing good work starts to "back-slide," the fact is promptly discovered without waiting a year. In one case, a welder who had made a very good test specimen, failed badly on being retested a year later, but made an excellent specimen after being fitted with glasses. The change in his sight had taken place so gradually that he was not aware of its seriousness until his welds were tested.

Serves as Check on Work of New or Distrusted Operators

When a new welder is employed, he may be required to make several specimens to demonstrate his skill. If there is reason to believe certain operators are not doing good welding, the same action is taken. When a program is started where no testing has been previously required, it is well to make the first three specimens shown in the attached schedule, for the first test, and follow with the rest of the specimens once a month for a "regular diet."

*"A Consideration of Qualification Tests for 'Class 2' Arc Welding," by R. B. Lincoln, *The Welding Engineer*, Sept., 1935.

Test specimens should be broken as soon as possible after they are welded, a note made of their quality, and the fracture shown to the welder. In this way he still has clearly in mind the methods used, and if defects exist, he has a good opportunity to determine their cause.

Preparation of Specimens Should Be Supervised

The welding of specimens should always be "witnessed" or supervised by an inspector, foreman or other responsible supervisor, so that there can be no doubt in anyone's mind as to the value of the test. The inspector need not stand over the welder or devote his entire time to it. For example, he may be checking dimensions on a finished part while several welders make specimens nearby. He should be sure that they are made by the men being examined without assistance from others, in the position specified, and by the process and equipment used in regular production.

Anyone who has had the experience of having his wife ask every evening whether he had passed the test will realize the temptation to do a little "crooked work" if needed. If but one man resorts to such practice, the entire program becomes of doubtful value.

It is a good plan to keep a permanent record of each test, so that the progress of each man may be easily noted. It will be found that poor welders sometimes make a good specimen, but that a really good welder never makes a poor one. Too much importance should not be placed on the results of one specimen, but by comparing the results of tests

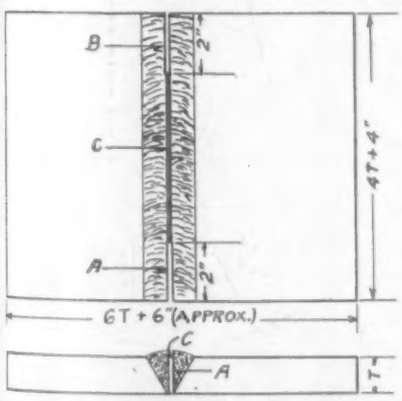


Fig. 3. Another Type of Welded Plate.

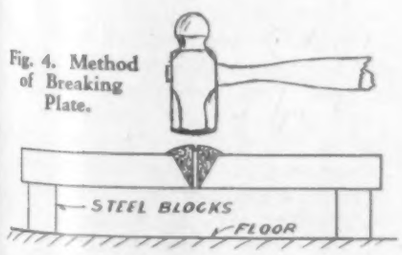


Fig. 4. Method of Breaking Plate.

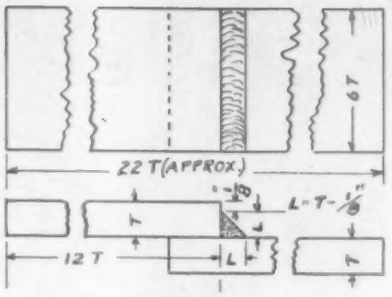


Fig. 5. Fillet-Weld Specimen—Two Pieces of Equal Thickness.

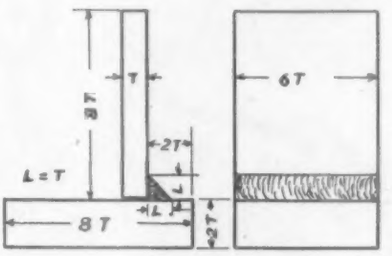


Fig. 6. Fillet-Weld Specimen—Heavy Plate Horizontal and Light Plate Vertical.

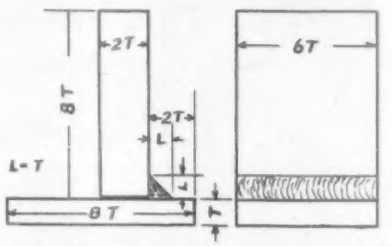


Fig. 7. Fillet-Weld Specimen—Heavy and Light Plates Interchanged.

covering six months' or a year's time, a very good measure of the welder's skill is secured.

For the purpose of making records, the following ratings are suggested:

EXCELLENT—No undercut, gas pockets, slag inclusions or defective fusion. Uniform grain structure of the type known to be typical of the welding process used. In this connection, it should be noted that the appearance of the fractures of gas welds differs from that of arc welds.

GOOD—No undercut, and not more than six defects per square inch of a size visible to the naked eye, the maximum dimension of any defect not exceeding $\frac{1}{16}$ in.

FAIR—Not more than six defects per square inch exceeding $\frac{1}{16}$ in. in any dimension, and the maximum dimensions of any defect not to exceed $\frac{1}{16}$x$\frac{1}{16}$ in., $\frac{1}{16}$x$\frac{1}{4}$ in., or $\frac{1}{32}$x$\frac{1}{2}$ in.

POOR—The combined area of all defects in any one square inch not to exceed $\frac{1}{8}$ sq. in. This represents about the poorest weld that may be safely used with a factor of safety of four for dead loads.

UNSATISFACTORY—All specimens having greater defects than those described above should be rated as unsatisfactory. The workman should be taken off production welding and given additional training.

Rating Is Based on First Specimen or First Set

The rating of each man should be based on the first specimen or set of specimens that he makes each month, because it is typical of the work he has been doing. Little is gained by permitting him to make several trials until one is produced that can be rated good or excellent. Almost any welder will happen on a good specimen after enough trials.

Fig. 1 shows a suitable butt-weld specimen for fracture tests. It is cut into three strips by gas cutting. The specimen marked 1 is nicked with a hack saw along one fusion zone, as shown in Fig. 2, the second one is nicked at the center of the weld, like the standard nick-break specimen, and the third one along the other fusion zone. The fusion-zone nick-break specimens are used because the standard one does not reveal defective fusion except near the root or when it is extremely bad. All the specimens are broken edgewise, with blows, or in a press, and the fracture examined. Rating is based on the poorest specimen.

Pipe May Be Substituted for Plate, When Checking Pipe Welders

For pipe welders, the specimens may be cut from pipe. One welder need not weld the entire circumference of a pipe—doing only enough to permit cutting out the required specimens, thus saving labor and material. The specimens, either plate or pipe, can be welded in any of the four welding positions, and in several thicknesses, to provide variety.

The plates can be made 4 in. longer than shown and a 2-in. strip discarded from both ends of the weld, as is done in the A. S. M. E. Unfired Pressure Vessel Code, if the same procedure is followed in production welding. For machinery manufacturers, a welder should be able to produce a good weld the entire length of a joint, and for this reason it is recommended that no discard be permitted.

Fig. 3 shows a specimen adapted to single-V butt welds. The weld is gas cut along its center line, at *A* and *B*, for 2 in., and the center part nicked with a sharp chisel at *C*, to make sure that it will break in the weld. It is then broken in a press or with blows, as shown in Fig. 4, and the fracture examined. By nicking both top and bottom with a chisel this specimen may be adapted to double welds. It is particularly handy when many tests are to be made, because the broken pieces can be rebeveled and used repeatedly, thus saving material.

Fig. 5 shows a specimen suitable for a fillet-weld fracture test. It is chosen because heavy welds on such specimens can be broken without special apparatus. Figs. 6 and 7 show two fillet-weld specimens suitable for testing the welder's ability to secure perfect fusion on the heavy plate, without undercutting the lighter one. The dimensions given are convenient, but may be varied to use up scrap material. Two tests can be made

SCHEDULE OF YEAR'S TESTING PROGRAM.

Test No.	Fig. No.	Type of Weld	Size of Weld	Welding Position
1	1 and 2	Double-V	1"	Flat
2	5	Fillet	¾"	Vertical
3	6	Fillet	½"	Overhead
4	3 and 4	Single-V	½"	Horizontal
5	1 and 2	Single-V	¾"	Flat
6	7	Fillet	¾"	Vertical
7	3 and 4	Single-V	1"	Overhead
8	1 and 2	Single-V	¼"	Horizonta
9	6	Fillet	½"	Flat
10	1 and 2	Single-V	½"	Vertical
11	5	Fillet	¾"	Overhead
12	1 and 2	Double-V	1"	Horizontal

with one set of plates, like Fig. 5, and four with Fig. 6 or 7, by welding the unused edge, after the specimen is broken.

A one year's testing program, suitable for a shop welding machinery from plate ¼ in. to 1 in. in thickness in all welding positions, is suggested in the accompanying schedule. In many shops, the work is positioned so as to avoid overhead welding, in which case the overhead specimens should be omitted.

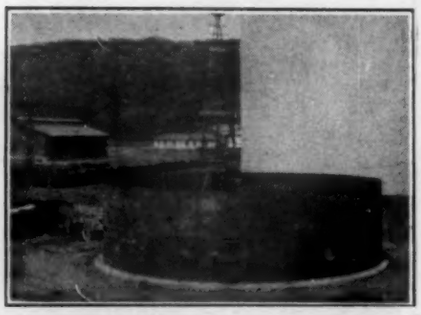
All-Welded Oil-Storage Tanks in South Africa

By G. CONSANI
Consani's Engineering (Pty.) Ltd.
Capetown, South Africa

When the management of the Atlantic Refinery Co. of Africa, Ltd. decided to extend the capacity of their bulk installation for petrol and paraffin, they had two tanks erected in Durban of 120,000 and 400,000 gallons, respectively, and one in East London of 450,000 gallons capacity. The tanks were electrically welded throughout and the contract was entrusted to the writer's company.

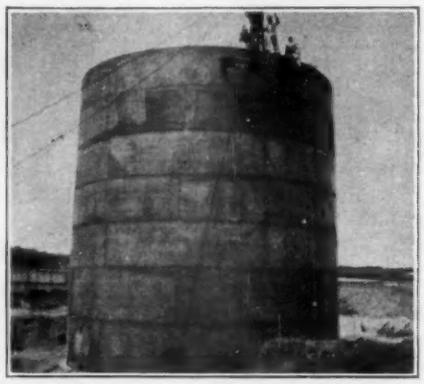
As there were no precedents in this country for this kind of work, and as the printed matter available on the subject was scarce and not very adaptable, the initiation of the construction was almost experimental and had to be undertaken with caution.

Foundation Laid for 400,000-Gallon Tank at Durban.



Durban Tank During Erection.

Erection of 450,000-Gallon Tank at East London.



East London Tank Nearly Completed.

Assembly with auxiliary bolts and tack welds was the method adopted on the first tank, but a later experiment revealed that to eliminate all bolts and adhere to the method herein described was far more practicable.

First of all a circumferential foundation 2 ft. 6 in. wide was laid out, the inside of which was filled with river sand, since the sand obtainable in the near vicinity contained certain vegetable and chemical matter which would have had a tendency to render the steel plates more liable to corrosion.

The plates were then placed on the sand with a 1½-in. overlap, and were fused with three runs of electric welding.

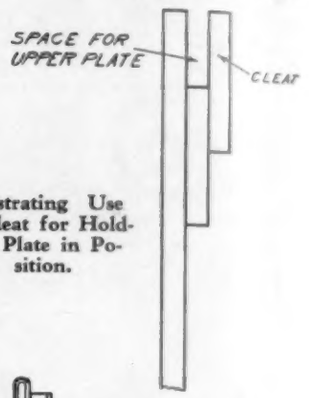
The sequence of the welding had to be carefully considered in order to allow for expansion and contraction of the metal. The method finally adopted is illustrated in one of the sketches. When the base of the tank was complete the first ring of vertical plates was erected on the circumference, care having been exercised to keep the plates dead vertical, and square with each other; a minimum overlap of 1½ in. was allowed. The second ring was then added to the first ring, with a 1½-in. overlap; this was easily carried out by introducing cleats (as shown in one of the sketches), which were tack welded 1½ in. below the top edge of the first ring. As the plates were erected they were welded immediately, the welder resting on scaffolding, the brackets of which are also illustrated in one of the sketches.

In the case of the East London tank there were seven rings, each ring erected as described.

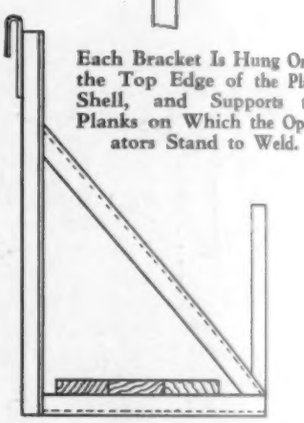
An angle iron was welded around the top of the last ring, serving as a rest for the plates of the dome roof. These plates were also overlapped 1½ in. and were supported by channel-iron trusses, which bridged across from the circumferential plates to the center column.

After the completion of the tanks, they were tested and passed to the satisfaction of the oil company's engineer.

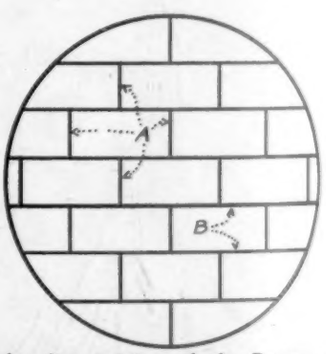
When these tanks were erected, this welding construction was considered novel; however South African engineers are gradually following the lead of their colleagues in other countries, and welding here is gradually replacing riveting in constructions of many descriptions.



Illustrating Use of Cleat for Holding Plate in Position.



Each Bracket Is Hung Onto the Top Edge of the Plate Shell, and Supports the Planks on Which the Operators Stand to Weld.



In the Construction of the Bottom, All Short Seams (Marked "A") Are Welded First, Followed by the Welding of the Long Seams (Marked "B").

Some Comments on Welding Procedure . . .

■ By LT.-COMDR. H. N. WALLIN
Construction Corps, U. S. Navy

OUTLINED herewith are a number of comments on certain aspects of welding procedure. It is believed that the subject matter may be of interest and helpfulness to engineers, supervisors, and welders who are striving to improve welding technique and welded products. The writer desires to state that the opinions and ideas expressed in this article are his own and are not official instructions of any Bureau of the Navy Department.

Cause of Shrinkage

It is generally known that serious difficulties frequently arise as a result of welding operations. The reasons for these various difficulties are not clearly understood by some persons, even by many engaged in the work. For instance, it is assumed by some that buckling is caused entirely by expansion of the metal on account of the application of heat, while actually this difficulty results from the contraction or shrinkage of certain areas of the heated metal during cooling.

This contraction or shrinkage occurs both in the parent metal which is being welded and in the metal being deposited by the electrode. It is easy to see why contraction occurs in the weld-metal as it cools, but it is not so evident why the parent metal contracts. Here is the explanation:

The heat of welding causes the parent metal to expand at the point heated, but it is restrained by the unheated metal which surrounds it, from expanding proportionately to the heat applied; thus the pressure developed in resisting expansion causes the heated metal to thicken or upset. As this upset area cools, it contracts and the net result of the welding operation is a shrinkage or lessening of dimensions.

Effects of Shrinkage

If a weld is made entirely across a plate the shrinkage should be uniform, and there should be no buckling or warping, but only a shortening. If it is not uniform, the part of the plate which is the least shortened will buckle in order to accommodate itself to the adjacent dimensions. The removal of buckles is accomplished either by elongating the shrunken area or by upsetting the area which is not shrunk. The latter method is usually employed and is accomplished by heating and hammering or only by heating. When heat is applied, the metal tends to thicken at that point; this is because the compressive stresses of the buckle cause a slight flow of the hot, plastic steel.

Another effect of shrinkage is the tendency of a plate to curl up slightly toward the side on which a weld is laid down. In other words, the weld has a knuckling effect. This is very noticeable where stiffeners are welded to bulkheads and where frames, etc. are welded to the shell. Small buckles or hollows occur in the plating, especially thin plating, between the supports.

Shrinkage Stresses

Shrinkage stresses usually occur in all welded structures, but they may be avoided or at least minimized. Consider the case of a plate across which a continuous weld is made. If one end of the plate is free to move, there will be no shrinkage stresses set up because the part of the plate between the weld and the free end will move bodily toward the weld as shrinkage occurs at the point of welding. However, if both ends of the plate are so fixed in position that neither end can move toward the weld, very large stresses are set up which tend to pull the plate away from its attachments, which usually are welded or riveted joints. Such stresses are sometimes very great and sufficient to cause rupture of a joint. Even if rupture does not occur, it is apparent that it is liable to occur at any time in service, if even a small additional stress due to service conditions is imposed upon the structure. This fact shows the great importance of minimizing the stresses due to welding as much as possible.

"Locked-Up" Stresses

The above paragraph points out the meaning of the term "locked-up stresses." It means that a weld has been made in such a way as to make no provision for shrinkage, such as permitting a slight movement of parts toward each weld. This is a condition which must be avoided whenever possible. In cases where "locked-up" welds are necessary (such as a final closing-in weld) care and thought should be exercised to see that the structure is sufficiently flexible to relieve the stress, or that light peening of the beads is resorted to in order to elongate the weld metal sufficiently to relieve the stress.

Amount of Shrinkage

The amount of shrinkage to be expected in any weld depends upon the type of the weld. It is somewhat proportional to the amount of heat applied, and to the nature of the joint being welded. Butt welds, therefore, cause more shrinkage than fillet welds of the same size. T-welds do not cause much shrinkage of dimensions of the intercostal part because there are no continuous welds across the parent metal, but only along its edges; most of the shrinkage occurs in the continuous member, but the amount is reduced if another intercostal part is hard up against it at the same point on the opposite side—this arrangement limits the amount of "upsetting" of the heated metal.

It is believed by some that the use of large electrodes which carry more current than small electrodes is liable to cause a relatively greater amount of shrinkage than would be the case if the same amount of weld metal were deposited in successive layers or beads by smaller electrodes. This theory is not entirely correct because of the fact that each bead is, in effect, a new weld, and tends to produce a definite amount of shrinkage as such; hence, it is apparent that in many cases the combined shrinkage effect of three beads may well exceed the shrinkage effect of one large bead. Actually, it is a matter of judgment as to how many beads should be used for a given weld, and such judgment should be based on the various considerations which apply to the case.

The greatest amount of shrinkage is in a direction across the weld, and this is called transverse shrinkage. There is some shrinkage along the weld, and this is called longitudinal shrinkage. The longitudinal shrinkage is always very much less than the transverse shrinkage because of the supporting effect given by the unheated steel adjacent to the weld. In the case of transverse shrinkage, however, there is no supporting structure to resist shrinkage except when using intermittent welding; then the unwelded areas between the welded increments act as pillars to resist the

shrinkage. It is for this reason that intermittent welding produces very much less shrinkage (both transverse and longitudinal) than continuous welding.

Cumulative Effect of Shrinkage

The forces set up by shrinkage are cumulative; this fact is shown by the tremendous force exerted in the lifting of bows and sterns of vessels off the keel blocks. A clear description of the causes of cumulative shrinkage is very difficult to make, but can most readily be understood by noting what happens in the region of the bow to cause the keel to raise off the blocks.

First, any welding on the inner side of the keel plate tends to curl the keel plating upward—the sides of the plate as well as the ends. The forward end of each plate is less fixed in position than the after end, due to the weight over it, etc., so there is an increasing tendency for the forward end to lift up in order to relieve the stresses set up.

Next, as welding proceeds, the welds across longitudinals or decks or shell plates, shorten these parts, and as these parts are some distance above the keel they exert a pull aft on the stem, which tends to tip the bow back, and this also lifts the forward part of the keel. In addition, the pull thus exerted produces a tendency for unwelded joints of the upper structure to telescope or overlap, and such members must be cut short in order to fit properly to form a satisfactory joint to weld.

As welding then proceeds, the resulting shrinkage causes additional forces tending to raise the bow off the blocks, and to pull the shell in toward the center line. This can be resisted only by a proper distribution of turn-buckles, weights, shores, and by seeing that the structure is well supported by tack welds; the tack welding should be well in advance of the finish-welding and sufficiently strong to prevent the overlapping tendency.

Although the foregoing is not intended to deal with remedies, it might be pointed out that a partial remedy for the condition described above is to prevent telescoping of members if possible and also to change the sequence of the welding such that a part of it is done in a downward direction, if this can be done without too many "locked-up" welds.

Size of Electrodes

In ordinary structural work it should be the practice to use electrodes of the greatest size practicable. The size depends upon the nature of the work and also upon the ability of the welder, but a welder who is given an opportunity to gain experience in the use of large electrodes carrying high currents can satisfactorily use covered electrodes up to ¼ in. For fillet welds of ⅜ in. and above, it is practicable to use 3/16-in. electrodes, although there is some doubt as to the reliability of large electrodes for vertical and overhead welds. There are several reasons for using large electrodes, such as increased production, decreased cost of welding wire, greater utilization of the capacity of the welding machines and less shrinkage and consequent buckling and warping. For thin plating and small welds, the size of electrodes to be used is a matter of judgment, but of course must be relatively smaller than in the case of heavy work.

Undercutting and Other Defects

One of the most frequent defects in an otherwise good weld is the undercutting of the surface of a plate or shape. This is caused by excessive current, improper angle at which the electrode is held, or failure in technique. This defect is most apparent in the case of inexperienced welders using large electrodes, and can only be overcome by instruction and experience.

Another defect is "rolling" of fillet welds, and consists in having a full rounded surface of the weld but the legs of which are not adequately attached to the parent metal. This defect is not a usual one and is often caused simply by oversight.

A defect that is of major importance, but which can usually be detected only by observing the operation, is inadequacy of "burning in" of the parts being welded together. This defect is not frequent among good welders with satisfactory equipment, but nevertheless is an important point to check, especially in dealing with new personnel.

Weaving

Many welders, in order to make a nice-appearing weld, put the last layer of the metal into the weld with an exaggerated weaving motion, instead of laying the metal on in the form of a bead. This practice is not regarded very favorably, because such a weld for finishing over a series of parallel beads is usually so thin as to be only a shell. Consequently, the strength of such a weld at its surface may be low, and it is therefore deemed better to build the weld up with parallel beads, and if a more finished appearance is desired it can be obtained by a small amount of dressing with caulking tools.

For open butt welds and large fillet welds, a moderate amount of weaving of each layer is necessary in order to float out the slag.

Number of Beads

The number of beads required for a good butt weld or a fillet weld depends upon the size of the weld, the nature of the work, and the ability of the welder. As already mentioned, the best practice for ordinary structural work is to use as few beads as practicable. In particularly important work, however, welds should be laid down in three or more beads on account of the beneficial annealing effect which each successive bead has on the preceding beads.

Tack-Welding

The purpose of tack-welding is to hold the various parts of the structure in a fixed position. However, tack-welding should not be so substantial as to prevent breaking of the tacks and shifting of the parts in case the stresses due to welding in the vicinity become excessive. The breaking of tack welds is a signal that shrinkage stresses are excessive and that further thought and consideration should be given to the welding procedure being followed. Parts which are intended to relieve shrinkage should be left relatively free to move.

While it is desirable to assemble and tack-weld as much of a section of the structure as practicable prior to starting any finish-welding, it should always be borne in mind that tack-welds and a few fitting bolts are limited in the amount of weight which they can carry. This means that thought must always be given to the danger of collapse if erection is carried too far in advance of finish-welding.

Welding Sequence

One of the most important features of welding procedure is the sequence, or order, in which various parts of the structure are welded together. As "there is more than one way to skin a cat," there is more than one particular sequence which will lead to satisfactory results. Yet, there are certain fundamental principles which must be observed, and these principles can be met by following more than one detailed sequence. Further, it is not desirable to lay down rules as to sequence which are so rigid that they have to be changed frequently on account of new developments, unforeseen difficulties, etc.

The proper sequence can be arrived at by making careful examination of the work to determine how the general principles apply to the local problem. The procedure should not be definitely fixed too far in advance of the work, and it should not be taken for granted that the procedure outlined on plans or accompanying sheets is entirely correct. Each problem should be studied on the job as to joints and connections, desirable starting point for welding, and the direction in which the welding should proceed. As previously stated, every problem is likely to be somewhat different, and the decision is a matter of thought and judgment.

Principles of Sequence Welding

The principles of sequence welding can be stated as follows:

First Principle: See that assembly is well ahead of finish-welding and that all

parts in the immediate neighborhood of the contemplated welding are properly secured by bolts, tack-welds, or both.

Second Principle: Examine the structure to determine whether there are in effect two main parts such as the internal structure (consisting of the longitudinals, transverses, bulkheads, etc., in the case of a ship) and the outside structure or wrapper (consisting of the shell). If there are two separate parts of the structure, each part should be completed separately before they are joined together by finish-welding. The internal structure of a ship should as a rule be completely finish-welded as a unit before finish-welding to the shell is undertaken in the immediate neighborhood. This avoids a considerable amount of local deformation and guards against "locked-up" welds.

Third Principle: Examine the structure to determine the general direction of progress of the finish-welding. The progress should be always directed toward areas which are free to move—that is, toward slip joints, toward the bow or stern, or toward the outer edges of bulkheads, decks, etc.

Fourth Principle: From the starting point the finish-welding should proceed step by step progressively in directions in which the structure is not made fast. This step-by-step procedure means that each attachment between the internal structure and shell, for instance, should be made as it is reached. No welds should be passed over, because such a weld would then become a "locked-up" weld.

Fifth Principle: All welding should be by the step-back-method in order to facilitate the dissipation of heat. The "wandering sequence" is sometimes used to spread the heat, but this method should not be used unless there are good reasons for it and unless the structure is sufficiently flexible to relieve the stresses which might be set up thereby.

Sixth Principle: In the case of symmetrical assemblies, it should be the practice to finish-weld both sides simultaneously. If, however, this results in two welders being so close together as to concentrate too much heat in one area, the symmetrical welding should be accomplished by one welder shifting from one side to the other. For instance, the welding on a bulkhead should be carried on simultaneously on the port and starboard sides, but it would be poor practice to work welders on the forward and after sides of the bulkhead at the same time.

Seventh Principle: Riveting in way of welded work should not be started until all of the welding is completed in that particular area. Joints which are to be riveted may be used as slip joints to allow for shrinkage effects, and therefore the parts should be free to move slightly to relieve shrinkage stresses. Assembly bolts should be examined from time to time to insure that a reasonable amount of freedom is not being prevented.

A Welding Engineer's Wife Speaks Her Mind

■ By MILDRED KINKEAD

Chicago

Up there on the south shore of Lake Michigan is a wonderful city—Chicago. Its size stuns you, its architecture enthralls you, and its presumptive wealth staggers you. Driving along the North Shore, lined with mammoth new apartment houses whose suites rent for colossal sums, you feel that Chicago is wealthy beyond imagination. Great fleets of pleasure boats are anchored in the city's very dooryard, expensive hotels are bustling with travellers and year-round residents pampered with every conceivable luxury. Department stores that are the very last word in mirror-and-chromium swank, are too glutted with trade to take care of your wants. A day in the Loop and you forget there was ever a depression.

The suburbs look prosperous, too. Evanston's Northwestern campus was swarming with fur-coated students; the buildings looked painted and polished and swept, like the rest of Evanston, and in fact the whole North Shore. Only the unfinished Bahai temple in Wilmette, with its dome of stone lacework towering over the skeleton foundation half-hidden in a jungle of weeds, suggested any uncompleted purpose in these well-fed villages.

Fascinating is Chicago's South Side Chinatown. We passed through it on our way to the Stockyards Amphitheatre, that immense building that housed the welding exhibit, and which was resurrected over the smouldering ruins of the old building after the stock-yards conflagration of last year. Some Chinatown buildings are true pagodas with curling roofs. The streets were filled with babbling Chinese of all ages. Our own city (Cleveland) has a modest Chinese quarter, but nothing so realistic as Chicago's version of Peiping.

Chicago leaves the provincial visitor, like myself, stupefied. New York I can understand. It seems to stop where Hackensack begins, but Chicago seems never to end. Just keeps on going, all built up, and dense with people. You wonder how any city can service so many human beings, employ them, feed, barber and transport them somewhere every day. Bring them gas, milk, and water, and haul away their refuse. My own city with its trifling million people has to keep wide awake, governing and teaching and policing its unruly body of citizens. How Chicago handles its untold millions I can't conceive. I give up.

A Piece of My Mind

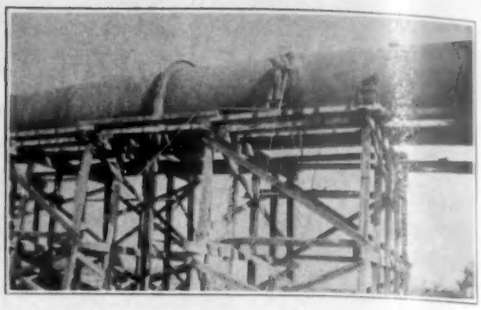
Well, folks, I've been in Chicago attending the annual welding conference and exhibit of the American Welding Society, in company with my husband. We had such a good time that I want to urge you men to take your wives to these affairs even if you must scrape the family till to do so. It is a real tonic for us women to see new cities, meet our husbands' friends, and get a little luxury into our ways of living. That goes double, too, because you men are likely to get into ruts in your lives, just as we are, and a change of scene and some relaxing companionship can work wonders.

You men need to take things easier. Heavens, we married you because you had nice easy faces to look at, among other things, and when you screw them all up into knots and put deep wrinkles into those good-looking foreheads, agonizing over your work, we women don't like it. We protest. Speaking for myself, I'll gladly go on living without an ermine coat to my back, if my husband will take life easier and play around with me more.

On that point, I am convinced that women have a better sense of living values than men have. Men want to be solvent and powerful and respected; women want to enjoy life. When you can find a man who adds enjoyment of life to the other trinity of goals, you've got something.

Know what I mean? Well, you got the general idea if you saw the movie, "The Thin Man." Of course its gangster plot was depressing, but the melody of the domestic theme carried along by William Powell and Myrna Loy took your mind off the sinister rumblings of crime. As husband and wife, they wise-cracked amiably throughout the whole play, and if you are skeptical about the way audiences received this innovation in domestic manners, you have only to check up and discover that the play was runner-up to "It Happened One Night" in box-office gleanings last year. So, men and women, if you want to stay young and "smooth," work a reasonable amount, forget it and play a lot. Mentally, I mean; romping in night clubs isn't necessarily play. If it's work for you, it isn't your sort of play. Maybe yours is badminton. At any rate, men, take your wives along. Their minds need recreating, too, and whatever you invest will pay rich dividends in mental health and contentment for both of you.

All-Welded Irrigation Pipe . . .



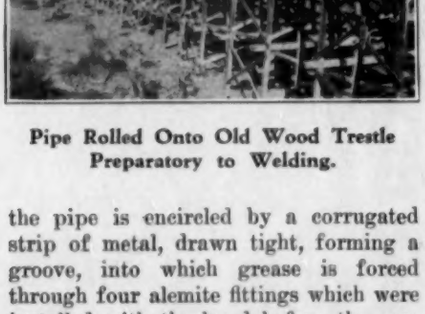
Welding on 10-Ft. Irrigation Pipe
(At the welder's left is one of the steel columns and ring girders.)

is featured by unique expansion joint and hinged supporting columns

THREE installations of ¼-in. steel pipe, 10 ft. inside diameter, on the main canal of the Beardsley irrigation project of Maricopa County Municipal Water Conservation District No. 1, west of Phoenix, Ariz., are of particular interest to engineers and others because of the unusual type of expansion joint used, and the fact both the pipe and structural-steel supports are all-welded. Two of the installations are 420 ft. long and the third is 360 ft. long. Each is welded into one continuous pipe, with a 3-in. expansion joint at the lower end.

Taking Care of Expansion at Canyon Crossings

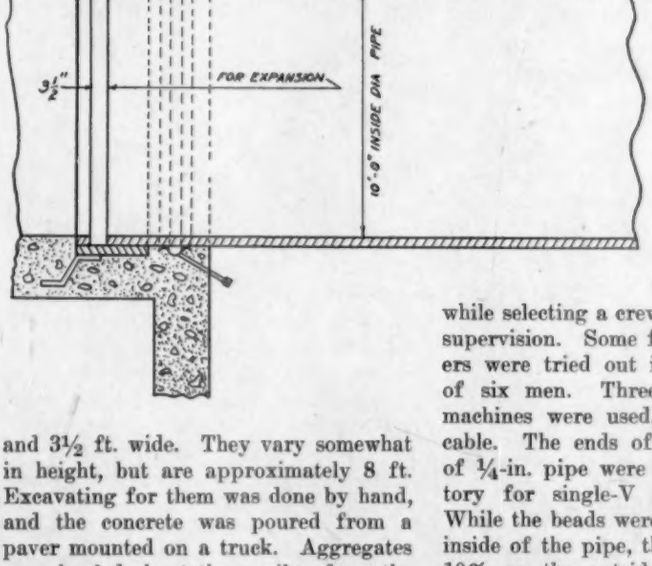
In the intense desert heat of this section, the taking care of expansion was a most important part of the plans for the three canyon crossings, but engineers for the district worked out the grease-sealed slip joint, which has now been in use for some time and has shown no leakage. The lower end of the pipe slips inside a fixed steel collar 12 in. wide, held in concrete by an angle flange, welded on. At this point a 3½-in. gap was left at the end of the pipe to provide for expansion. Back of this gap



Pipe Rolled Onto Old Wood Trestle Preparatory to Welding.

the pipe is encircled by a corrugated strip of metal, drawn tight, forming a groove, into which grease is forced through four alemite fittings which were installed with the band before the concrete was poured. This grease serves the double purpose of lubrication, allowing the pipe to slip endwise readily as expansion occurs, and of sealing off the water and preventing leakage.

Expansion of the pipe was further provided for by hinging the all-welded steel columns, which support it at 60-ft. intervals, at both the top and bottom ends. The steel hinge members were anchored to the concrete pedestals of the columns by 3½-ft. anchor bolts in the concrete. The pedestals are 20 ft. long and 3½ ft. wide. They vary somewhat in height, but are approximately 8 ft. Excavating for them was done by hand, and the concrete was poured from a paver mounted on a truck. Aggregates were hauled about three miles, from the Agua Fria River. The ring girders which hold the pipe in place are of rolled steel, made in two sections and drawn together and welded on the job.



Cross-Section of Grease-Sealed Slip Joint.

Pipe Was Shop-Welded and Shipped in 30-Ft. Lengths

The steel columns were welded in the factory of the Western Pipe & Steel Co., at Los Angeles, Calif. The pipe itself was welded into 30-ft. lengths at the factory and shipped to the nearest railway point, from where it was hauled to the job on trucks and rolled onto the old wooden trestle which had supported the old flume across the canyons. The pipes were lined up on these trestles by the Western Construction Corp., of Phoenix, using a shovel equipped with an extension boom.

The field joints, both of the pipe and of the ring girders, were welded by the Arizona Welding Co., of Phoenix. Since the inside of the joints must be flush and smooth, to avoid debris gathering inside the pipe, the strict inspection proved an acid test of welding ability while selecting a crew under government supervision. Some forty or more welders were tried out in selecting a crew of six men. Three portable welding machines were used, with 1,000 ft. of cable. The ends of each 30-ft. length of ¼-in. pipe were beveled at the factory for single-V butt-welded joints. While the beads were laid flush with the inside of the pipe, they were reinforced 10% on the outside. The inside was brushed with a wire brush.

Holes Were Cut in Pipe to Pass Welding Cables Through

Shielded-arc electrodes of 3/16- and ¼-in. sizes were used. For inside work, it was necessary to cut holes in the pipe to receive the cables, about 100 ft. apart, these being welded up afterwards. Some of the work was over 57 ft. in the air, and the rough terrain made the transportation of equipment to the job difficult.

These installations were part of a general improvement to the irrigation system, including several miles of concrete lining in the canals and ten miles more

which is to be lined later in the year. This lining is placed over a welded mesh reinforcement. Improvements are also to be made to the Lake Pleasant dam, at the head of the canal, including work on the spillway to increase its capacity. The irrigation system supplies water to a rich farming district west of Phoenix, and the lining of the canals is expected to save a large percentage of water which formerly seeped away.

Chicago Section Opens Fall Season

"The Development of Refinery Equipment Through the Aid of Welded Construction" is the subject of a talk to be given by J. F. Risdon, refinery engineer, Texas Corp., Lockport, Ill., at the October 25th meeting of the Chicago Section of the American Welding Society, which meeting opens the fall season.

A course of lectures on "The Fundamentals of Metallurgy as Applied to Welding," to run through the fall and winter, will be outlined at this meeting by Jules Muller, consulting engineer, Chicago Steel & Wire Co., who will give the opening lecture in the series.

The meeting will be held in the Brevoort Hotel, 120 West Madison St., in the Gold Room, beginning at 8 p. m. A dinner at 6:30 will be served in the same place, immediately preceding the meeting.

Welding Engineering Course Taught at Cleveland

A special 5-day course in welding engineering is being offered in Cleveland by the John Huntington Polytechnic Institute in cooperation with The Lincoln Electric Co. This course is being conducted once each month, November excepted, through to May. It consists of day sessions at the Lincoln plant and evening sessions at the Institute, the latter being devoted to lectures and discussions.

The purpose of this course is to study the arc-welding process and its applications to design and fabricating problems. Such subjects will be considered as the value and use of the electric arc, calculation and distribution of stresses in welded joints, study of polarized light and rubber weld models, penetration, designing for arc welding, estimating welding costs, and organizing the welding department.

This course has been given in previous years and has proved highly popular. Further information regarding it can be obtained from E. W. P. Smith, Welding Engineering Department, John Huntington Polytechnic Institute, Cleveland, Ohio.

Get "*H. O. T.*" on Welding

■ By H. O T. RIDLON

[This section is dedicated to Better Welding and Better Welding Shops. Suggestions and criticisms are invited.]

Hol Huml Shows, Shows, Shows!

Nothing to do now but work until the next one, which is the International Acetylene Association, to be held during the middle of November in Cleveland. But honestly, they were grand. To begin to tell you about them all would take days of writing, and then I could not begin to do them justice. But it was swell to see so many of my old friends at them, and particularly in Chicago during the National Metal Congress.

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High Spotting the National Metal Congress

Fo'give me for any omissions I make about people or things, 'cause I couldn't see everything and everybody, and space would not permit in any event.

"Bill" Stoody was seen about the place for a few days, and of course "Chuck" Phillips from Detroit was with him most of the time. Now, there's a team for you.

"Bob" Kinkead was among the notables of the industry present. With him was his wife. I'll be interested in reading her column this month.

Lots of cutting machines were being shown, but the one that caught my eye was the "Corta." Boy, they sure were doing some plain and fancy cutting with that baby, and how it can do it. My, my, how times do change!

That new bronze, No. 520, looks mighty sweet. That's the one American Brass just recently brought out. They tell me that on a galvanized job it's the nertz. Gotta try it out right pronto. Hope this comment brings me at least a small sample.

That Bingrod looks pretty good, too, for an inexpensive hard-surfacing rod. I'm running some tests on it now. Perhaps I'll have more to report in a few months.

Another thought for large manufacturers who use welding is to look into this "Magnaflux" for finding flaws. I says, keep an eye on that stuff.

These little a.c. welders sure are finding their place in the sun. Bill Pearson of Westinghouse was showing their new little unit. Think it is a 150-ampere baby for about two hundred bucks. Sure is a dandy for small-shop work. I really could rave quite a lot about it. Now don't get me wrong, there are other good ones on the market also; but there are some that are pretty punk, to my way of thinking. But keep your weather eye on these a.c. machines. They are something to think about and consider when in the market.

Tested-and-Proven Sales Methods Will Work Anywhere

It is the strangest thing to me why welding-shop owners continue to try to kid themselves and everyone else in the belief that ideas and sales methods which prove successful other places cannot possibly be worked in their town. I don't know how many farm-machinery manufacturers there are, but I'm sure that there are not many. I know that the farmer in Maine buys the same kind of machines as the one in Illinois, or anywhere else, and that it is the same sales methods that sell each one. I know that about 50% of all welding torches in use are made by two companies. And there are plenty of various kinds of welding equipment. And you will find the same kind of welding torches and nearly every make from the Atlantic to the Pacific and from the Great Lakes to the Gulf. You find Fords everywhere, and farmer and welder both buy 'em. Why? Because they are sold with the same sound sales principles that it takes to sell welding or anything else. Welding-shop owners who follow those simple rules of business enjoy success and a good business. Many shops are like the colored gent that traded his dog for two cats, then the cats for a goat, then the goat for three rabbits, and he was so busy one of his friends asked him after all his trading had been going on for about a week how much money he was making and he said, "Oh, I ain't made a dime, but look at all the business I'm doing." About a year ago our editor told a story about two welding shops in Indiana that were in towns about twenty miles apart. In town "A" the welding shop owner said that he just couldn't sell hard-surfacing to the farmers around his town, but over in town "B" the welding-shop owner was enjoying a swell business on hard-surfacing from both towns "A" and "B." I have often wondered if that welding shop owner in town "A" ever tried to sell welding or hard-surfacing to anyone. *What do you think?*

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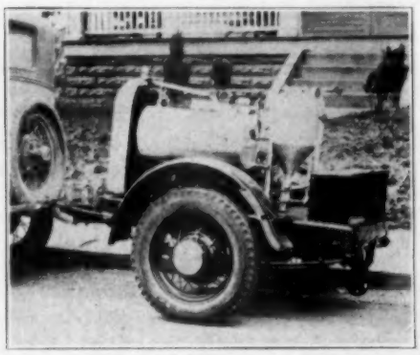
The Thought for the Month: I wonder who'll keep us out of war this time? It'll be you, and you, and you!

Portable Compressors Built by Welding

A portable air compressor, built largely by welding, employing a Model A Ford motor with a special head, is shown in the illustration. This unit was built by Huffman Bros. & Gavin, of Bluffton, Ind., for the Kelly Monument Works of that city for sand-blasting monuments in the field, thereby eliminating the need for bringing them to the sand-blasting plant.

The manufacture of this unit offers any welding shop a good opportunity for increased business, since every one needing a portable compressor is a potential prospect, says Fred G. Huffman, of Huffman Bros. & Gavin, who have since built two more units, one for a highway department and the other for a contractor. This firm is building and delivering an average of one of these machines a month. This makes a nice sideline to work on in spare moments.

The special head used with the Ford



Air Compressor Made From Ford Motor.

motor is obtained from Gordon Smith & Co., of Bowling Green, Ky., who also furnish the accessories. The special head changes the motor to a two-cylinder engine, with air being delivered by the other two cylinders. The device can be made automatic, delivering air up to a required pressure and unloading when that pressure is reached.

The tanks, tool and battery box, sand-blast unit, and framework and mounting are all are welded. The unit will operate any kind of air tool, including a riveting hammer, pavement breaker, etc., and Mr. Huffman says it performs beyond the expectations of anyone who has not seen it working on a job.

Milwaukee Section Holds First Meeting of Season

At the first meeting of the season held by the Milwaukee Section of the American Welding Society, on Friday evening, Oct. 11th, talks were made by James W. Owens, research engineer, Fairbanks Morse & Co., Beloit, Wis., and C. C. Crane, research metallurgist, Republic Steel Corp. Mr. Owens' topic was "Importance of Design and Workmanship in Welded Construction," and Mr. Crane spoke on "The Fundamentals of Metallurgy Involved in the Manufacture of Steel for Welding Wire."

Mostly About People

Intimate Items Recorded by "TROPEL"

What's His Age?

When Toastmaster Wright introduced the notables present at the annual banquet of the American Welding Society, on Oct. 3rd, he made a remark indicating his curiosity regarding the age of Dr. D. S. Jacobus, last-year's president of the Society. The Doctor is a familiar sight at these Fall Meetings, taking part in discussions, and meeting with the technical committees. Those who have strided along the street with him, as I have, hold a high regard for his agility.

As to his age, concerning which many have conjectured, one might get a clue from the fact that when he resigned from the faculty of Stevens Institute of Technology to accept a position with The Babcock & Wilcox Co., his colleagues roundly criticized him, pointing out that if he had remained at Stevens one year longer he would have been eligible to retire on a Carnegie pension. That was back in 1906. In this year 1935, the glint in his eyes deny that even yet he entertains any thought of "retiring."

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Hints to "Muskie" Fishermen

The season's fishing anecdotes are now a thing of the past, though I have yet to hear from Robert Notvest, J. D. Adam's technician, who recently spent several days in the North enticing the "muskie" with patent lures. When "muskie" fishing, a tight line is the rule, otherwise the hook is easily shaken out of his jaws, which are nothing but bone, with no flesh. That is another reason why you are warned not to put your fingers in his mouth or gills, if you would end the day with them whole.

Some years ago a lad in swimming in the Flambeau river in Wisconsin was attacked by a big member of this finny tribe. Before he was rescued by other bathers, the "muskie" had badly lacerated his hand, and today he still carries the scars of this encounter with him. This lad, grown up now and in business for himself, is Frank Haasl, now president of the Central Welding Works Co., Chicago.

Frank's father is an old-time river man, and his brothers are following the same occupation. They act as guides to tourists in the northern Wisconsin country around Park Falls, where they live. These boys and their father have guided many a boat over the rapids between Nine-Mile Landing and Oxbo, while perhaps some important Eastern capitalist sat in the stern and wagered that the craft would tip over, but the Haasls always won. If you want a trip that combines good fishing with magnificent scenery, you can't do better than to have one of the Haasl boys show you how it's done.

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"Goodie" Lands a Wife

On Saturday, Oct. 5th, H. A. Goodwin, of "Rego" fame, was married to Miss Jane Johnson, of Chicago. Ellsworth Mills, "Rego" vice-president, was best man. They left next day on an extended honeymoon. As regards the arrangements made for him and his bride, "Goodie" felt that one was "put over" on him by his friends, who failed to take seriously the parson's admonition that "What God hath joined together, let not man put asunder."

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Harvard Teaches 'Em How

Anyone who saw Comfort Adams, Harvard University erudite, waltzing at the dance on Thursday night, during the meeting of the American Welding Society, couldn't help but be impressed with the feeling that some of the same careful study he has given in the field of engineering has also been applied to the terpsichorean art. It is no wonder he was besieged with requests for dances even before the affair got under way.

Helpers No Longer Needed in Welding Tool Joints

Welders in the Mid-Continent oil fields, it would seem, are getting so proficient as to eliminate the use of their helpers. Anyway, it is reported that in welding the tool joint to the drill stem in rotary drilled wells, the joint can be turned by the use of a small chain tong manipulated by the welder with his left hand while the welding rod is applied by the operator's right hand. It is further explained that the pipe is racked. Upon two of the horizontal members making up the rack, small rollers are mounted. The frame supporting the rollers tapers so the pipe can be readily rolled up to the small wheels upon which it rests while the welder does his work. This procedure is now common practice in the Oklahoma and Texas oil fields. In previous practise, a helper ordinarily would be required to do the turning of the tool joint in this operation.

Welding News in Pictures

• 66-in. ventilator of sheet metal, weighing half a ton, for installation in a Des Moines movie theatre. Built by the Blackman Sheet Metal Co., of Des Moines, Iowa, who used considerable welding in its construction. A few of the shop men who had a hand in the work, posed for the picture.

• Arc welding the top seams of a dam gate at Guttenburg, Iowa.

• All-welded trolley frame for a 50-ton crane of 62-ft. 5½-in. span, built by the Cleveland Crane & Engineering Co., Wickliffe, Ohio, for the Gary plant of the Illinois Steel Co.

• These 38 tanks, built on one order for a large brewery, are each 11 ft. 9 in. in diameter and range in length from 10 to 27 ft. Each was proved leak-proof by a pressure test. Built by the Butler Manufacturing Co., Kansas City, Mo., with shielded-arc welding. (Photograph by courtesy of The Lincoln Electric Co.)

• It took only 6 hours to make complete this 50-lb. gear from plate material, the work being done by The Welding Shop, Snoqualmie, Wash. Holes were bored at the bottom of the teeth, and the gear was completed with the cutting torch. No filing or grinding was necessary.

San Francisco Section Holds "Old-Timers' Night"

The first fall meeting of the San Francisco Section of the American Welding Society was held on the evening of Sept. 25th at the Athens Athletic Club, in Oakland.

The meeting was primarily a social affair, being termed "Old Timers' Night", and was made interesting and quite enjoyable by the presence of many "pioneer" welders and welding engineers.

Door prizes donated by various local welding-equipment manufacturers and distributors were awarded, and motion pictures, free beer and sandwiches, together with the privilege of "free speeches" for all, were among the specially enjoyed features of the session.

Arrangements and program were planned by Chairman Charles Smith, E. L. Mathy, of the Program Committee, and J. G. Bollinger, secretary.

Purdue Conference to Be Held December 5-6

The 11th annual welding conference at Purdue University, Lafayette, Ind., will be held Dec. 5th and 6th, it is announced by Prof. J. D. Hoffman, director, Department of Practical Mechanics, Purdue University. The program of this conference is now being formulated and will be published in the November issue of *The Welding Engineer.*

National Metal Congress Sets New Records

A new high mark for attendance and size marked the National Metal Congress, which was held in Chicago, Sept. 30th to Oct. 4th. The registration totaled over 17,000, and more than 35,000 attended the exposition held in the Amphitheatre. The number of exhibitors and the space sold were greater than in any previous National Metal Exposition.

A high interest was evident at all the American Welding Society sessions, which were held in the Palmer House. The American Welding Society registered over 1100, which set another new record in a record-breaking week.

In addition to the technical program, as given in the September issue of *The Welding Engineer,* there were several social functions. On the night of Oct. 2nd, the members of the Milwaukee Section were guests at an entertainment especially prepared for them, and on the following night the annual banquet was held, including a delightful dinner, introductions by the toastmaster, D. C. Wright, chairman of the Chicago Section, a pointed talk by L. D. Gayton, acting city engineer of Chicago, an hour and a half of fun and mystery by Dr. Harlan Tarbell, famous magician and exponent of eyeless vision, and dancing to the strains of entrancing music.

On Friday, quite a number spent the day inspecting welding operations in the plants of the Goodman Manufacturing Co., Chicago Bridge & Iron Works, and the South Works of the Illinois Steel Co.

Special trips to points of interest, and dinners, were held throughout the week for the enjoyment of the visiting ladies.

Navy to Build Large Floating Drydock

Plans by the U. S. Navy Department are being completed for the early construction of a 37,000-ton steel floating drydock. The huge dock will be the largest ever built—1016 ft. long, 165 ft. wide, and 75 ft. from top of the deck to the keel. Considerable welding will be employed in its construction. The port where its construction will take place has not as yet been determined, but as the dock is to be assigned to Pearl Harbor, Hawaii, it will doubtless be built somewhere on the Pacific coast.

Wyoming Welding Shop Serves Vast Territory

One welding job performed by the Taylor Steel Co., Casper, Wyo., may be for an automobile garage at Cody—about 275 miles northwest. The next may be for an oil company drilling in the new field at Lusk—107 miles east. And the company will handle the work in the same matter-of-fact way that it does anything from its home town.

Is there anywhere in the United States a welding business whose trade territory is larger than this one? It is all in the day's work for the Taylor shop to handle jobs from a territory 400 miles square. A high percentage of the work is on a credit basis. Most welders serve a single community—the Taylor Company serves considerably over half of a very large state.

Wyoming is a state of great distances, with towns spaced wide apart. Casper, population 20,000, where the Taylor Steel Co. is located, is in the east central part, and is the logical trading point of an immense territory. Cheyenne is about 200 miles southeast of Casper, near the Colorado boundary.

Some of the towns which the Taylor Steel Co. serves with welding service, both electric and gas, are, to the west and north: Lander, population 1800, about 160 miles distant; Riverton, population 1600; Thermopolis, 2100; Worland, 1460; Greybull, 1800; Shoshoni, 275.

To the north, there are such towns as Sheridan, 8000; Buffalo, 1750. Sheridan is approximately 200 miles distant.

Towns to the south and southwest include Douglas, 52 miles, 2000 population; Wheatland, 120 miles, 2000 population; Chugwater, 150 miles, 300; Rawlins, 120 miles, 4900.

To the east are Torrington, 2000; Lusk, and Newcastle. Newcastle is close to the South Dakota line, northeast of Casper nearly 200 miles, with a population of 1200.

Over this immense territory, Mr. Taylor has developed volume for his shop by personal contacts. Making a wide-circle trip, he will call on garages, oil companies, and other prospects. The contact is an informal one. Adapting himself to small-town psychology, he gets acquainted with the propect, and, in a pleasant way, tells him about the equipment and service which his shop is able to deliver.

He discusses, naturally, too, transportation. In this respect the situation has improved to the point where there are really excellent facilities. Besides rail service, Wyoming shippers have the benefit of an efficient network of truck lines. Casper, as the principal town, is a focal point for these.

Promptness is an objective of great importance. It is seldom when a job is received that the formality of an estimate is resorted to. The customer has confidence in the Taylor shop; Mr. Taylor knows the customer. He sees that a first-class job is done promptly, and billed at a fair price.

Quality is, of course, extremely important in this service to a large territory. If it is bad for a job done for a local customer to fail to stand up in use, what is the picture when a job which has been shipped 275 miles, two ways, proves unsatisfactory? There is but one answer, and that the inexorable one that the job must be done right and stay right.

Mr. Taylor came to Casper in 1911, and put up the first steel storage tanks in the local oil fields. His company, as its name indicates, also deals in steel. He finds the trade combination a good one. Interesting to the welding trade in other sections of the country is the statement that, even under depression conditions, the supply of skilled welders is exceedingly limited in the Casper territory. On government reemployment records, welders are frequently found, says Mr. Taylor, but investigation seems invariably to show that the men in this territory have very limited experience.

Chicago Operators to See Welding Demonstrations

Motion pictures and demonstrations on gas welding and welding equipment will be given by H. A. Goodwin and H. L. Comisky, of The Bastian-Blessing Co., and Mr. Colby of the Machinery and Welder Corp. will demonstrate arc welding, at the monthly meeting of welders to be held at 741 West 70th St., Chicago, at 7:30 p. m. on Nov. 4th.

What's New in

Equipment and Accessories

High-Production Machine for Flanging Heads

A high-speed flanging machine for flanging boilers and tank heads, either flat, bilged, concave or round, is announced by the Blue Valley Machine & Manufacturing Co., Kansas City, Mo.

This machine provides unusually high flanging speeds. Only one minute's time is said to be required for making a 2½-in. flange on a 12-ft.-diameter flat head, ¼ in. thick.

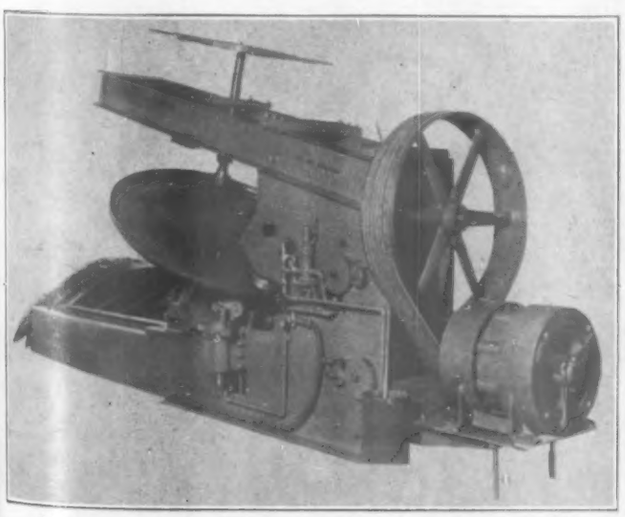
The machine illustrated is 5 ft. wide by 16 ft. long by 6 ft. high. Construction is characterized by simplicity and strength. The flanging mechanism is mounted on the main frame.

All operations for flanging are performed through a centralized group of controls, located so that the operator has a clear view of the work at all times.

When the flange is completed, the working rolls and the center hold-down are backed off, releasing the work. Due to the arrangement of the rolls and controls, flanges are made without any signs of distortion or wrinkling in the finished head, despite high-speed operation.

The rolls are made of high-grade tool steel. All revolving parts are equipped with roller or ball bearings. Power for operating the machine is supplied by a 15-hp. "Linc-Weld" motor.

These machines are available in six sizes, ranging in length from 10 to 16 ft., in width from 18 in. to 5 ft., and in height from 5 to 6 ft. Capacities range from 30-gauge thickness, 12 in. diameter, to ⅝-in. thickness and 20 ft. diameter.



This Flanging Machine Is Capable of Making a 2½-In. Flange on a 12-Ft.-Diameter Flat Head, ¼ In. Thick, in One Minute.

Hollup Announces Sureweld Type "N" Electrode

An all-position, straight-polarity shielded-arc electrode, known as Sureweld "N," has been announced by the Hollup Corp., 3357 West 47th Pl., Chicago, Ill. This rod is also said to be equally efficient when used with reversed polarity. It performs admirably with either direct- or alternating-current welding, it is claimed. The protective slag coating is easily removed with a wire brush. Physical properties of metal deposited from Sureweld "N" are: yield point, 50,000 lb. per sq. in. minimum; ultimate strength, 70,000 lb. per sq. in. minimum; and elongation in 2 in., 25% minimum.

A. C. Welders Have Current Range of 15 to 275 Amperes

Alternating-current transformer-type arc welders that make welds quickly and efficiently on light-gauge metals have been announced by the Miller Electric Manufacturing Co., Inc., Appleton, Wis. These machines are an improved type of "Miller" arc welder and are said to weld steels down to 26 gauge, with an amperage from 15 to 275. They are also recommended by the manufacturer for cold welding motor blocks, heads and cast-iron parts. These welders are complete with welding leads and hand shield, and are equipped with handles for portability. They are made in three sizes: 15 to 150 amperes, which handles 1/16- to 5/32-in. rod; 15 to 275 amperes, which handles 1/16- to ¼-in. rod; and the junior welder, giving 15 to 90 amperes, for small power service.

"Miller" Portable Welder Equipped With Leads and Hand Shield.

They have no moving parts, and the arc is said to be especially stable. They operate on 220 volts, 60 cycle, single phase.

New Welding Cable Stands Severe Wear and Abrasion

A new type of welding cable designed to meet conditions of extremely severe wear and abrasion, has been announced by The Lincoln Electric Co., Dept. CC-178, Cleveland, Ohio. This cable, known as "Realwear," consists of fine tinned copper wire laid in ropes and stranded. Individual ropes are alternated in succession as regards the direction of the lay to prevent distortion in applications of severe usage. The conductor is insulated with an especially developed rubber compound to provide firm adhesion between the cover and rubber insulation.

High-grade cotton, woven on a loom and securely joined to the rubber belt by a special process, forms the cover. The finish is said to be resistant to oil, grease, acid, gasoline, moisture and heat, and the cable is comparable to fire hose in strength, it is claimed.

A length of this cable was tied to a delivery truck and dragged over pavement for about 20 miles, after which inspection showed that the cover had hardly worn through. The cable is available in sizes 2, 1, 0, 00, 000 and 0000.

New Wall-Type Manifold for Acetylene Cylinders

A new wall-type acetylene-cylinder manifold, the Oxweld Type M-8, has just been announced by The Linde Air Products Co., 30 East 42nd St., New York, N. Y. It is available in a 10-cylinder unit, to which extensions in units of 5 or 10 cylinders can be made,

and has been accepted by Underwriters' Laboratories for listing under their Re-examination Service. This manifold comprises two high-pressure header units feeding into a central regulation system which delivers acetylene to the distribution-piping system at pressures up to 15 lb. per sq. in.

The header unit assemblies are composed of heavy seamless steel tubing with forged steel union connections having stainless-steel seat inserts. The header valves for cylinder connections are threaded directly into the steel-tubing header and are connected to the cylinder valves with coiled leads provided with a flash arrester and a ball check valve in the header end to prevent acetylene from being driven back into an exhausted cylinder.

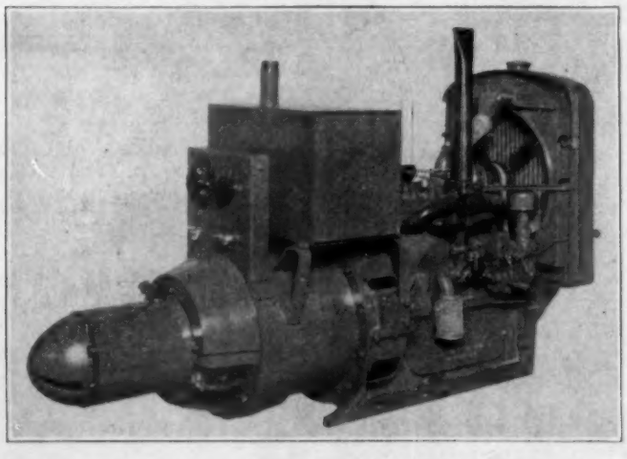
Rod for Welding "Stabilized" 18-8 Stainless Steel

A new stainless-steel welding rod which, when used with "treated" or "stabilized" 18-8 steel, retains full corrosion-resistance and heat-resistance in the plate and weld without resort to heat-treatment, has been announced by The Linde Air Products Co., 30 East 42nd St., New York, N. Y. This rod, known as Oxweld No. 28 Columbium-Treated 18-8 Welding Rod, contains a definite quantity of columbium, which is a stabilizing element, tending to prevent the formation of chromium carbides with resultant intergranular corrosion. The rod is said to require no different technique from that usually employed in welding stainless steel.

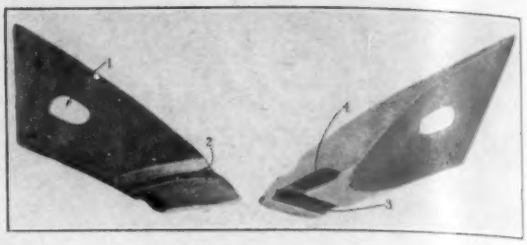
Close-Coupled 200-Ampere Engine-Driven Welder

A new 200-ampere special engine-driven "Shield Arc" welder is announced by The Lincoln Electric Co., Cleveland, Ohio, who claims this to be the lowest priced welder of this type ever placed on the market. This new model, known as the "200-Ampere Shield Arc Special," supplies a uniform current for welding with bare or heavy-coated shielded-arc electrodes in all sizes up to ¼ in. The welding current range is from 60 to 250 amperes. No external reactance or stabilizer is required. Dual control of welding current is provided by adjustment of both the series and shunt fields. Separate excitation of the generator shunt fields is supplied by an exciter connected on the generator end of the unit. A generator-field rheostat and a current-regulating switch are mounted vertically on a "dead-front" steel control panel. Electrode and ground cable connections are of the wing-nut type and are in an easily accessible position.

The welder is powered by a Waukesha 4-cylinder engine, which delivers 23 hp. at 1400 r.p.m., the speed at which the welder is operated. A gear-driven governor maintains the proper engine speed at all load conditions. The engine is direct-connected to the generator shaft. Due to this close-coupling feature, the unit is compact and weighs only 1,078 lb.



Special Engine-Driven "Lincoln" Welder Rated at 200 Amperes.



Forged Plow Points That Can Be Welded to Share Without Cutting Off Old Point. Inlay Grooves Are Filled With a Hard Alloy.

High-Carbon Forged Plow Points for Arc Welding

Forged plow points, made of 0.90-carbon steel, are now being sold by the New Process Plow Welding Co., 1116 First Ave., Perry, Iowa, and are recommended for application to worn shares by the electric-arc method only. The following features are claimed for this new type of point:

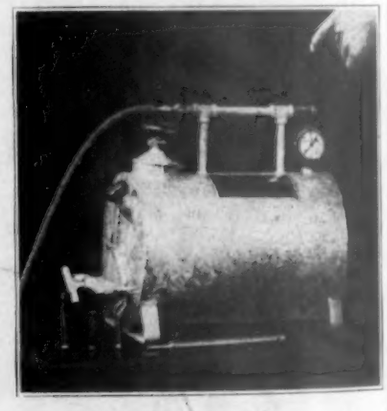
(1) It is not necessary to cut off the point of the old plowshare. (2) New points are formed to fit with "New Process" cutting edges. (3) Alloy-inlay grooves (designated as 2, 3 and 4 in the illustration) causes the point to repoint itself and to remain sharp after long service. (4) This point does not have to be drawn in the fire.

New "Meco" Electrode Holder

The Meco "Ste-D-Arc" metallic-electrode holder has been announced by the Modern Engineering Co., 3411 Pine Blvd., St. Louis, Mo. One of the features of this holder is its light weight. Fiber cups protect the shield spring against heat. The copper grips are of the bull-dog type and are renewable. The holder is easily and quickly fastened to the cable in the field without special tools. It is designed to prevent undue discomfort to the operator, and to give long wear and service.

Light-Weight Generator for Soldering and Brazing

The "Ace" portable soldering and brazing outfit has been placed on the market by Reiner & Campbell, Inc., 242 Lafayette St., New York, N. Y. Only 17 in. long, 13 in. high and weighing but 35 lb. when charged, the outfit can be readily transported to the soldering, heating or brazing job. The soldering iron can be changed instantly to any size or shape, and the iron can be regulated to any degree of heat. By putting a blowpipe on the torch, brazing can be performed.



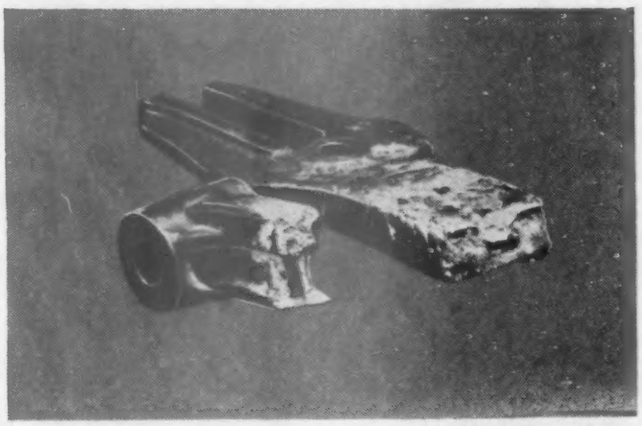
"Ace" Acetylene Generator.

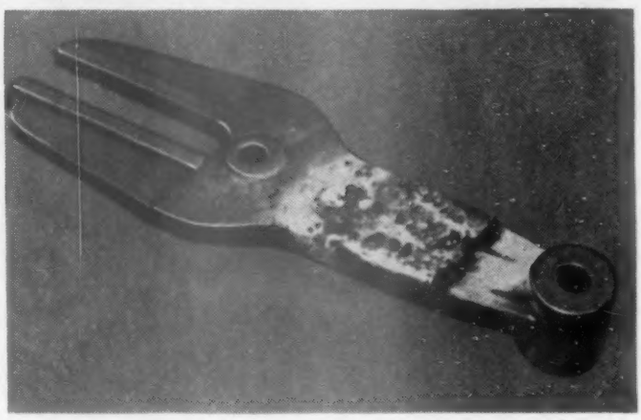
"Ace" generates its own fuel from carbide and keeps the iron hot during use. It is said to be cheaper than electricity, illuminating gas, gasoline or charcoal. The generator is filled with water to spout level, carbide is then placed in the drawer, and acetylene gas

Four Successive Breaks...

but not one occurred in the

TOBIN BRONZE *Welds*





WHEN too much strain caused this connecting rod to break, it was repair-welded with Tobin Bronze. Again it was overloaded and broke, *outside of the weld*...and again it was repair-welded with Tobin.

This happened twice more. All told, the connecting rod broke four successive times, but each time it failed in the parent metal—not once in the Tobin Bronze welds.

So...we repeat: Well-made Tobin Bronze repair welds on cast iron are stronger than the castings themselves.

Don't take a chance with an *unproved* rod. Ask for and get genuine Tobin Bronze. Its name is stamped every 12 inches in each rod. It is one of 17 dependable Anaconda Welding Rods, some one of which is suitable for every bronze welding purpose.

ANACONDA
From mine to consumer

THE AMERICAN BRASS COMPANY
General Offices: Waterbury, Connecticut
Offices and Agencies in Principal Cities
In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

MELTING POINTS OF ANACONDA WELDING RODS

Material	Approximate Melting Point—Degrees	
	Cent.	Fahr.
Tobin Bronze*	885	1625
Manganese Bronze	870	1598
Brazing Metal	930	1706
Economy Bronze*	885	1625
Everdur*	1019	1866
Anaconda 520	885	1625
Phosphor Bronze A	1050	1922
Phosphor Bronze E	1070	1958
Phosphor Bronze D	1000	1832
Phosphor Bronze C	1025	1877
Silicon Copper	1083	1981
Deoxidized Copper	1083	1981
Electrolytic Copper	1083	1981
Super Nickel	1225	2237
Nickel Silver	1055	1931
Ambrac*	1150	2102

*Trade-marks Reg. U. S. Pat. Off.

More than a century of metallurgical experience gives an *extra value* to every welding rod which bears the name TOBIN BRONZE.

35229

ANACONDA WELDING RODS

is immediately generated, which heats the iron. One charge of carbide is said to keep the iron at any desired temperature for approximately 4 hours. The generator can be recharged during use.

The "Ace" outfit can be immediately changed into a powerful torch for melting or burning solder or paint. It can also be used for auto-radiator repairing, light brazing and lead burning. Its users include sheet-metal workers, coppersmiths, tinsmiths, automobile mechanics, shipyard and railroad workers, and also industrial workers engaged in soldering or brazing or using a portable torch.

Trade Literature

"Automatic Arc Welding by the Electronic Tornado" is the subject of a 42-page booklet recently published by The Lincoln Electric Co., Dept. CC-178, Cleveland, Ohio. Illustrations and text describe the operation of the carbon arc and the part played by the shielding gases. Information is given on the physical properties of welds made by this method. A table gives speeds and costs for various types of welds on different thicknesses of general-purpose steel. Many applications of the process are illustrated and described.

"Arc Welding Electrodes and Accessories" is the title of a new booklet by The Lincoln Electric Co., Dept. CC-178, Cleveland, Ohio. Complete descriptions, applications and procedures are given for electrodes for all welding purposes and for hard-facing, including tables showing current range and arc voltage for various sizes of electrodes for different welding positions. Accessories and supplies are also described, and photographs of interesting applications are reproduced.

Their complete line of accessories is listed in catalog No. 4-A, just published by the Machinery and Welder Corp., 240 S. Boyle Ave., St. Louis, Mo. Electrode holders, cable, cable connectors, plugs and receptacles, lugs, helmets, hand shields, goggles, respirators, lenses, cover plates, C-clamps, protective clothing, wire brushes, flint lighters, welding and cutting hose, hose clamps, hose connections, splicers and nipples, coupling adaptors and wrenches are listed.

"The Utility of Carbide Residue" is the title of a 20-page booklet issued by The Linde Air Products Co., 30 East 42nd St., New York, N. Y., explaining how owners of acetylene generators may capitalize on this valuable residual by-product. Many uses are pointed out where carbide residue is said to give superior results over other forms of slaked lime.

"Industrial Eye Protection" is the title of catalog No. 35, issued by the American Optical Co., Southbridge, Mass. A section is devoted to goggles, helmets and glasses for welding. A table gives recommended shades of Noviweld and Calobar lens for different types of welding, including density of the recommended shade, visible-light transmission, and percentage absorption of ultra-violet and infra-red rays.

"Weld It Well," a 24-page bulletin issued by the Harnischfeger Corp., 4513 W. National Ave., Milwaukee, Wis., has been reprinted in a new 1936 edition. This bulletin covers the complete line of P&H-Hansen arc welders from 50 to 800 amperes, as well as welding fixtures and accessories. Condensed specifications and performance data also are included.

"The Metallizer Gun — New 3-in-1 Unit" is the title of a folder issued by the Metallizing Co. of America, Inc., 1218 Long Beach Ave., Los Angeles, Calif., pointing out the features of operation and construction of this gun. A speed and efficiency table for 18 sprayed metals is also included.

"Dalweld" detachable cable connectors are described and their features pointed out, in a folder issued by The Dallett Co., 165 W. Clearfield St., Philadelphia, Pa. The RS-Weld flux sealer and Duro electrode holder also are listed and described.

"Manganal" applicator bars, welding electrodes, forged wedges and wedge bars, all made of manganese steel, are listed and applications described in a folder issued by the Stulz-Sickles Co., 91 N. J. Railroad Ave., Newark, N. J.

"Electrodes for Making Machinable Welds" is the title of a new bulletin by American Arc Welders, Roseau, Minn., describing Nico, Copper Arc, Bronz Arc and Arcast electrodes and giving information on their applications.

Commercial News

Milwaukee School to Hold Annual "Open House"

The Milwaukee School of Engineering, 120 N. Broadway, will hold an "open house" on Nov. 7th and 8th, planned along the same lines as the similar function held last year. Each day, from 4 to 10 p. m., a program will be given, including talks and demonstrations. Manufacturers of welding apparatus are being invited to exhibit their products.

Clinics Announced for Houston and Atlanta

Two welding clinics, featuring oxyacetylene welding and cutting, have been announced by The Linde Air Products Co., sponsors. One will be held Oct. 23rd to 26th in the Sam Houston Convention Hall, Houston, Texas, and the other is scheduled for Oct. 30th to Nov. 2nd at the Georgia School of Technology, Atlanta, Ga.

Daily programs include individual instruction in all types of oxyacetylene welding and cutting, demonstrations of everyday applications and of recent developments in apparatus and techniques, also discussion groups and motion pictures. Operators and students will be given an opportunity to practice under the direction of men experienced in particular phases of the process, and executives and engineers are invited to discuss their maintenance and production problems with qualified experts.

Similar meetings to these were held by the Linde company last year in Birmingham, Houston, Cleveland and New Orleans, and drew a total attendance of over ten thousand.

For the most outstanding advertising campaign of the year in the field of metals, the Republic Steel Corp. was awarded first prize by judges at the 13th annual conference of the National Industrial Advertisers Association, held at Pittsburgh, Pa., Sept. 18th to 20th. S. A. Knisley, advertising and sales promotion manager of Republic, states that the prize-winning campaign was created and placed by the G. M. Basford Co., industrial advertising agency, with offices in New York and Pittsburgh.

C. B. Herrick, salesman for The Lincoln Electric Co., who has been stationed in Kansas City, Mo., for the last six

months, could not keep his mind off Cleveland attractions. As a result the announcement of his wedding was made for Oct. 14th. Miss Marjorie Merriam, daughter of Vice-Pres. Merriam of the Lincoln company, is the bride.

Joseph T. Ryerson & Son, Inc., recently completed an extensive addition to their Jersey City plant, making available an additional 45,000 sq. ft. of floor space for the stocking of steel and allied lines. The new warehouse is a two-story brick building, equipped with a heating system for holding the temperature at a uniform degree, thereby preventing any condensation of moisture or suddent change that might affect the quality and finish of special steels.

William M. Black has been elected vice-president in charge of sales of the American Manganese Steel Co., Chicago Heights, Ill. Mr. Black has been connected with the company in a sales capacity for over 20 years. At one time he was in charge of the Pittsburgh office, later becoming eastern sales manager at New York, and in 1934 he was appointed general sales manager with offices at Chicago Heights.

Jules Muller, formerly chief engineer of the Hollup Corp., has resigned that position and become consulting engineer and manager of welding-wire sales with the Chicago Steel & Wire Co., 10257 S. Torrence Ave., Chicago, Ill. Prior to joining the Hollup Corp., Mr. Muller was in the research department of the A. O. Smith Corp., Milwaukee, Wis.

The Baltimore Tube Co., of Baltimore, Md., has been acquired by Revere Copper and Brass Incorporated. R. S. Stringer, the Philadelphia representative of the Baltimore company, is now connected with the Philadelphia sales office of Revere Copper and Brass, where he will continue to handle the products of the Baltimore Tube Co. Division.

The Steel Sales Corp., 129 S. Jefferson St., Chicago, Ill., announces the following transfers in the Welding Division: Russell W. Pursel has been transferred from Chicago to the St. Louis district as service engineer. Robert Prill is transferred from Chicago to the Detroit district as service engineer.

"Cutting and Miscellaneous Uses of the Oxyacetylene Flame" was the subject of a talk by J. J. Crowe, of the Apparatus Research and Development Department, Air Reduction Sales Co., New York, before the Minneapolis, Minn., Chapter of the American Society for Metals, on Oct. 2nd.

The Pittsburgh sales office of the Republic Steel Corp. has been removed from 4th and Bingham Sts., S. S., to 1832 Oliver Building. F. M. Welsh continues in charge. The Union Drawn Steel Co., a Republic subsidiary, will move into an adjoining suite in the Oliver Building.

G. B. Purcell, Inc., Detroit, Mich., division of Thomas Welding Laboratories, has been appointed distributor of "Manganal" electrodes, applicator bars and forged wedges, made by the Stulz-Sickles Co., and "Okocord" welding cable, made by the Callender Cable Co.

The Carnegie-Illinois Steel Co. is the name of the new corporation resulting from the merger of the Illinois Steel Co. and the Carnegie Steel Co., both subsidiaries of the U. S. Steel Corp. These two companies represent over 20,000,000 tons of steel-ingot capacity.

A complete line of welding rods for both gas and electric is listed, and welding technique and applications described, in a 31-page catalog just issued by the Steel Sales Corp., 129 S. Jefferson St., Chicago, Ill. Welding accessories are also listed.

Additional frontage of 175 ft. on Pine St. has been acquired by the Modern Engineering Co., 3411 Pine St., St. Louis, Mo., at a reported cost of $26,500. The new property also borders on Channing Ave. and is improved with five houses.

John D. Swain, vice-president of The Linde Air Products Co. and Union Carbide Sales Co., has been made vice-president of the Electro Metallurgical Sales Corp. All these companies are units of the Union Carbide & Carbon Corp.

The Champion Sales Co., 2832 East Grand Blvd., Detroit, Mich., have been appointed as distributors, in the Detroit territory, of welders manufactured by the Owen Electric Manufacturing Co., Fayetteville, N. Car.

The Queen City Supply Co., Pearl & Elm Sts., Cincinnati, Ohio, has been appointed distributor for "Manganal" products made by the Stulz-Sickles Co., 91 N. J. Railroad Ave., Newark, N. J.

V. Gilmore Iden has been made secretary of the American Institute of Steel Construction. Mr. Iden has been with the Institute since 1927, and during the past year served as acting secretary.

C. C. Crane, formerly chief chemist and metallurgist for the Keystone

RYERSON

Safest Source

for

WELDING ROD

● **Change—improvement and better welding practice continues to characterize the welding industry. New, especially engineered rods are helping to speed up work and at the same time give better results. Alert shops are continually checking, testing and keeping abreast of the newer developments. Our own engineers have developed rods that we know are outstanding for quality production. These rods have been especially designed for particular applications. And the wide range of Ryerson rods covers the entire field of welding.**

Have you tried the newer Ryerson rods? We would like to have you test them in your own shop—and let their performance tell the story. We will be glad to furnish samples. Address the nearest plant.

23 TYPES TO CHOOSE FROM

ELECTRIC RODS

Ryerson Shielded Arc Type No. 215
Ryerson Shielded Arc Type No. 216
Ryerson Shielded Arc Type No. 217
Ryerson Green Processed No. 18
Ryerson Green Processed No. 6
Ryerson Bare Mild Steel
Ryerson Brown Processed
Ryerson White Flux Coated
Ryerson High Carbon White Flux Coated
Ryerson Blue Flux Coated
Ryerson 3½% Nickel Steel Flux Coated
Ryerson High Manganese Steel
Ryerson Hard Surfacing
Ryerson Allegheny Stainless Flux Coated
Ryerson Allegheny Stainless No. 44

GAS RODS

Ryerson Copper Coated No. 206
Ryerson Copper Coated No. 210
Ryerson Cast Iron
Ryerson 3½% Nickel Steel
Ryerson Tobin Bronze
Ryerson High Carbon Bare No. 2110
Ryerson Allegheny Stainless Bare
Ryerson Hard Filler

Bulletin No. 56, sent on request

JOSEPH T. RYERSON & SON, INC.

Chicago, Milwaukee, Philadelphia, Cleveland, Cincinnati, St. Louis, Buffalo, Detroit, Boston, Jersey City

Steel & Wire Co., Peoria, Ill., recently joined the Republic Steel Corp. as research metallurgist in the wire plant at Chicago.

Notes From the Field

Specializes in Repairing of Aluminum Crankcases

Because of their successful methods in the welding of aluminum, the Acme Welding Co., 15th and Shotwell streets, San Francisco, Calif., have within a few months taken over 75% of this type of work let out by the Packard, Cadillac and Lincoln dealers and shops in the city.

"Aluminum welding of this kind is necessary as a rule only on crankcases of the large 12- and 16-cylinder V-type motors," explains W. Sommers, owner. These crankcases are of a cast aluminum alloy. Breaks seem to come most frequently at the flywheel housing. This is probably due to the weight of the large number of cylinders on the unusually long casting, and the fact that the flywheel housing supports the entire rear of the engine and transmission housing as well."

"These breaks," says Sommers, "usually follow clear around the circumference of the flywheel housing so that the rear of the engine drops completely.

"Welding such breaks is done with an aluminum rod and oxyacetylene torch. The work is difficult, as it must be done without disturbing either the crankshaft, camshaft, or starter gear. Also, the completed job must take as great a strain as the original housing."

Welding Shop Teaches CCC Group

A class of about 20 students in welding from the Government CCC Camp just east of Bluffton, Ind., is being handled by Huffman Bros. & Gavin, of that city. This, together with more than a 100% increase in business for this firm over last year, has so taxed their facilities that they have had to install a new 125-ampere arc welder, giving them a total of three welders in a town of only 5000 population. They have just completed three jobs of ornamental fence and railing work that netted them a neat profit. They are also building a portable air compressor, for which they find a wide demand, a description of this machine appearing elsewhere in this issue.

Petrie Bros. Body & Welding Works, of Pomona, Calif., recently reorganized from the Petrie Welding Works, has opened for business at the location of the latter named concern, at 274 N. Garey Ave. A new building has been erected for more convenience and added working space. The two brothers, F. A. and A. J. Petrie, joint partners, have been in the welding and auto-body business in Pomona for several years. "F. A." was formerly in charge of the welding department of the Pomona Valley Machine Works.

The Treadwell Construction Co., of Midland, Pa., was low bidder on 750 tons of welded dredge pipe for use in connection with federal government construction on the Ft. Peck Dam in Montana. The bids, which were taken by the U. S. Army Engineers office in Kansas City, specified welded pipe, 28 in. in diameter and of 12 ft. 6 in. lengths. The Treadwell company just recently completed 18,000 tons of similar pipe for the same project.

Besides the usual run of welding repair work, N. Peterson, operator of a blacksmith and welding shop in Niles, Mich., has recently been engaged in repairing lead-ins for big switchboards used in connection with controls for electric furnaces. He straightens these lead-ins when they become bent. Mr. Peterson recently signed a contract with the Hibbard Co. to make steel baskets in which exposed films will be bathed.

An electric-welding unit driven by natural gas as motor fuel was recently placed in use by the Slauson & Santa Fe Welding Works, in Huntington Park, Calif. The unit comprises a new 300-ampere generator driven by a Hudson motor, and operates efficiently on the natural-gas fuel at a marked saving over gasoline, according to Mr. Mehuron, proprietor.

The U. S. Army Engineers office in Pittsburgh has been requested by army headquarters in the New Orleans district to inspect 1,698,000 sq. ft. of galvanized welded wire fabric at the plant of the American Steel & Wire Co., U. S. subsidiary, at Donora, Pa. The fabric is for use in flood prevention work on the lower Mississippi River.

A large amount of welding will be employed in the early construction of a new airplane factory at 5701 Imperial Ave., Mines Field, Los Angeles, Calif., for North American Aviation, Inc. The Consolidated Steel Corp., of Los Angeles, was awarded the contract for 700 tons of steel for the building, including fabrication.

Being the only welder in town especially equipped to do automobile-radiator repair work means that Gus Muntz, operator of a welding shop in Niles, Mich., has plenty of business coming in now. In addition to his specialty, Gus also does general welding repair work.

The Atlas Scraper & Engineering Co., of Bell, Calif., manufacturers of all-welded heavy road scrapers and rippers, are adding a 90-ft. runway to their crane at the company's plant on Maywood Ave. The crane is 90 ft. high. The shop will also be extended in the near future.

A new 300-ampere motor-generator welding unit will assist the Western Welding Works of 749 East 15th St., Los Angeles, Calif., in production work on a new line of water heaters designed for hotels and apartment houses. M. McClanahan is proprietor of the concern.

S. W. Morgan, of Los Angeles, Calif., recently added electric welding to his general repair shop equipment at 4301 Downey Road. Mr. Morgan was formerly associated with the West Coast Forwarding Co., having charge of welding and truck maintenance work.

D. L. Paden, of Hynes, Calif., recently added electric welding to his repair shop at 6971 Paramount Ave. A gas-engine-driven 300-ampere machine was installed for use in Mr. Paden's specialty work of repairing heavy trucks and in general automotive repair work.

Walt's Garage & Welding Shop, Maywood, Calif., is now located at 5109 Maywood Ave., having moved there from 4103 Downey Road. The shop, which formerly limited its service to oxyacetylene welding, is now equipped with an arc welder.

The Eaton Metal Products Co., of Omaha, Nebr., has been busily engaged in making a one-piece, all-metal body for garbage haulers. Ten of these bodies have been in service in Omaha for a year and have given thorough satisfaction.

The Pacific Gas & Electric Co., of San Francisco, Calif., recently began laying an 8-in. welded gas-gathering line in the Tracy gas field to furnish additional gas for the main trunk line from Kettleman Hills to the San Francisco Bay district.

The Lang Transportation Co., pipeline contractors of Los Angeles, Calif.,

Go After Welding Jobs on Compression Castings

Have you noticed that gray iron castings are being improved and their strength increased by the addition of Nickel and Molybdenum (Moly)? Moly added to gray iron closes the grain which prevents leakage under high pressure and temperatures; it also adds wear resistance and strength and increases the toughness. The addition of Nickel to this close grained casting increases its resistance to corrosion.

Moly-Nickel Rods

of same content as compression castings, will help you get and retain these jobs by giving clients welds that serve the same purpose for which they pay extra for Alloyed Iron Castings.

Moly-Nickel Analysis

Carbon—
3.30 to 3.50

Manganese—
.50 to .70

Sulphur-Max
.10

Phosphor
.15 to .30

Nickel
2.00 to 2.25

Molybdenum
.40 to .60

Some Moly-Nickel Applications

Gears
Flywheels
Valves
Pulleys
Dies
Cylinder Liners
Cylinder Blocks
Cylinder Heads
Clutches
Brake Drums
Pistons
Bottle Molds
Ingot Molds
Hot Water Heaters
Exhaust Manifolds
Frames for Machine Tools

For ordinary cast iron welding, to obtain high strength and machinability demand Fuse-Well, the most popular oxy-acetylene cast iron welding rod manufactured. Available in six sizes either □ or O.

Write for Name of Nearest Distributor and gratis sample of Moly-Nickel Welding Rod.

Fuse-Well Cast Welding Rods

Chicago Hardware Foundry Co.

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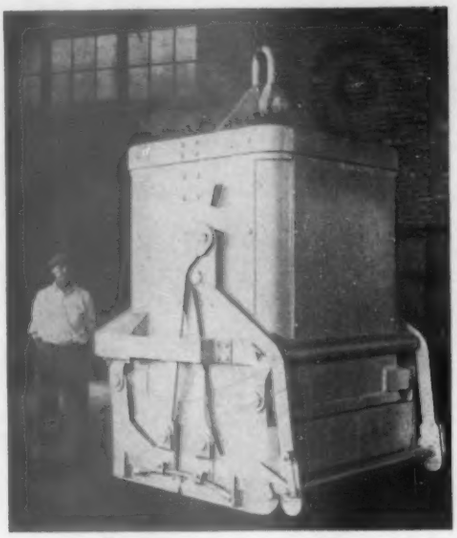
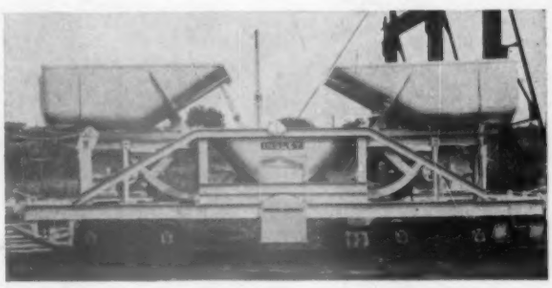
Largest Manufacturer of Cast Iron Welding Rods



ADAMS ELECTRODES WELD HUGE NORRIS DAM EQUIPMENT



The concrete handling equipment illustrated above was made by the Insley Manufacturing Co. of Indianapolis, Ind., for the Tennessee Valley Authority. These special cars and buckets (each bucket weighing 7,000 lbs. and carrying 24,000 lbs. of concrete) are all-electric-welded with Adams "Tank-Craft" Electrodes. The 68,000 to 72,000 lbs. per square inch ultimate tensile strength of "Tank-Craft" fusion metal with ductility of over 25% gives assurance that this equipment will withstand the heavy shock stresses to which it will be subjected.

Let us tell you more about these new "Tank-Craft" Electrodes, which may be used for horizontal, vertical or overhead welding.

The Adams line includes Arc-Welders, Automatic Welding Heads, Automatic Welding Wire, Shielded, Processed and Bare Electrodes and Welding Accessories.

J. D. ADAMS COMPANY

Arc-Welding Equipment and Electrodes
INDIANAPOLIS, INDIANA

have started the construction of a 7-mile welded 8-in. oil pipeline for the General Petroleum Corporation in the Mountain View oil field, near Bakersfield, Calif.

T. A. Hawley, proprietor of the Southern California Equipment & Repair Co., Los Angeles, Calif., engaged in repairing and rebuilding welding equipment, has moved from 3536 N. Figueroa to 237 E. Avenue 40.

Ed Anderson, formerly associated with the Emil Howe Welding Works, of Mateo and 9th Sts., Los Angeles, Calif., has opened a shop of his own at 3449 East 9th St., featuring general job-shop welding of all kinds.

A 9½-mile welded pipeline is being constructed by the Nevada Massachusetts Co., of Mino, Nev. The line is to convey water from Spearmint Springs to the Silver Dyke tungsten mine, southwest of Sodaville.

A new town, Rodesa, has grown up in Louisiana, just north of Vivian. Being an oil town, it already numbers among its businesses several equipment houses, gas companies and other types of concerns.

The Murdock Garage, Murdock, Neb., a town of less than 300 people, has purchased a 300-ampere electric welder and is making good with it on automobile work as well as heavier farm machinery.

The Omaha Steel Works have been awarded contracts for several state highway bridges. The company has just purchased another 300-ampere shielded-arc welder for use on bridge work.

Two river barges were built in Omaha during the last month. In both cases, the frame is a one-piece steel welded job. These are said to be the first barges to be built at Omaha.

In order to take care of outside calls, D. J. Bergman, of Medford, Ore., recently bought a new 200-ampere engine-driven welder which he expects to mount on a truck or trailer.

The Lathrop Polytechnic Institute, of Kansas City, Mo., is teaching a course in arc welding and recently purchased a new d.c. welder.

· CLASSIFIED ADS ·

Help Wanted—75c per line, minimum 4 lines. Jobs Wanted—4 lines free. Other Ads—$1.00 per line, minimum 4 lines. Count 8 words to line. Add 6 words for keyed address.

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WELDING HELMETS, GOGGLES AND GLASSES

Fiber helmets with No. 10 glass (for elec.), light weight and sturdy. Price	$5.75 ea.
2x4 glasses for above, any shade	1.60 ea.
Red fiber welding goggles (for gas welding)	1.35 ea.
Non-shatter grinding and chipping goggles	1.25 ea.

Highest quality, sent C.O.D., with the understanding that you may return within 10 days and we will refund full purchase price promptly. **Pavlik Bros., Kenilworth, Ill.**

Guaranteed Welders—Three Lincoln engine-driven arc welders. Priced low. Completely guaranteed. Other types in stock. Dealer's correspondence invited. Service Co., 3732 Cedar Ave., Cleveland, Ohio.

Bargains—Demonstrator Arc Welders. Gasoline and electric drive. 30 days' trial. Easy terms if desired. Write Ken's Exchange, Box U-1051, Troy, Ohio.

BUSINESS OPPORTUNITY

Shop for Sale—Auto-radiator and welding shop. Auto salvage. Arkansas location. A bargain for cash. Address O-3, The Welding Engineer.

POSITIONS WANTED

Acetylene and Electric Welder—General experience as supervisor. Will go anywhere. A-1 references. T. K. Mason, Dixie Hotel, Beaumont, Texas.

POSITIONS WANTED

Welding Supervisor—Experienced in structural-steel fabrication, tanks, steam and refrigeration pipe welding. 18 years machine-shop and job-shop work, gas and arc. Familiar with drawings and working out special designs. Position of responsibility, with future, desired. Will consider buying interest in small business. Address O-1, The Welding Engineer.

Sales Engineer—13 years' successful experience in the marketing of welding electrodes, arc-welding equipment and supplies. Desires a position with a manufacturer or large distributor of these products. Graduate in engineering, with a thorough knowledge of the applications of electric-arc and oxyacetylene processes in both production and maintenance work. Sales experience covers both direct sales to users and sales executive work in the selection and supervision of distributors throughout the United States. Complete details on request. Address O-2, The Welding Engineer.

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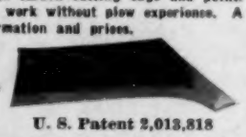

U. S. Patent 2,013,818

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